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CAN **LIFE-RELATED PROTEINS** FORM UNDER NATURAL CONDITIONS?

DOES GROUP SELECTION EXPLAIN **HOW MORALITY 'AROSE'?**

GANYMEDE'S MAGNETIC FIELD: YOUNG-AGE CREATION SOLUTION

Floating Islands WITH Monkeys & Trees

JOHN NELSON DARBY AND THE RISE OF OLD-EARTH CREATIONISM

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COVER: Common Gibbon (*Hylobates lar*) pale form, adult male, hanging on branch in rainforest of Central Thailand

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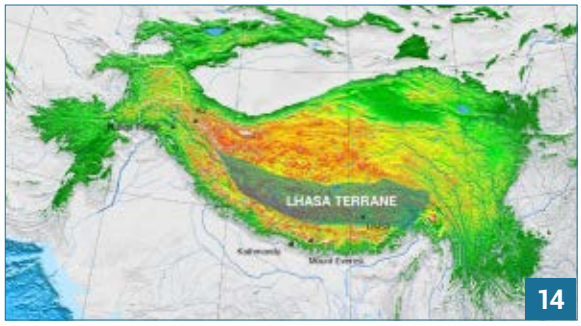

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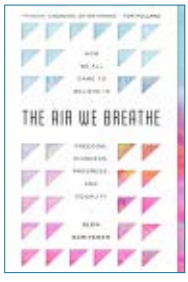

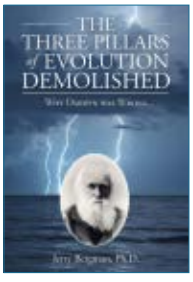

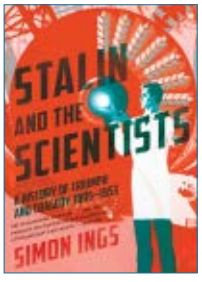

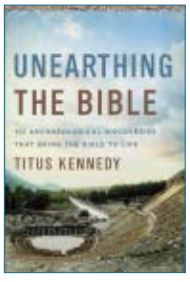

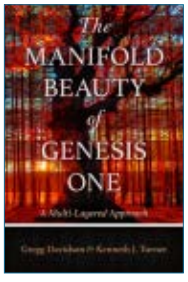

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The iron snow dynamo theory for Ganymede

Wayne Spencer

Ganymede is the largest moon in the solar system (figure 1). With a radius of 2,634 km, Ganymede is slightly larger than the planet Mercury.[1] A unique feature of Ganymede is that it possesses its own intrinsic magnetic field. To planetary scientists, it has been a challenge explaining how an object of Ganymede's size could still possess its own magnetic field after over 4 Ga. After billions of years, an object of Ganymede's size would be expected to have cooled down so that there would not be adequate heat to drive a magnetic dynamo. A dynamo requires a molten iron core that can have a convection motion of the fluid, which carries an electric current. But for Ganymede the iron core is only approximately 700–800 km in radius. Ganymede may not have a solid iron core, but has a liquid iron core surrounded by a silicate mantle, and then layers of water ice over the mantle.

Ganymede is influenced by the strong magnetic field of Jupiter, but there is a good consensus among scientists that it possesses its own intrinsic field.[2–4] The *Galileo* spacecraft conducted magnetometer measurements which have been analyzed in relation to Jupiter's field. Ganymede's main dipole field was measured as 719 nanotesla (nT) and is tilted 176° in relation to its own spin axis.[5] This makes it roughly antiparallel to Jupiter's magnetic field.

Radioactive heat sources and tidal dissipation have been considered for Ganymede and found to be inadequate to sustain fluid convection in the core. Tidal dissipation is not significant in heating Ganymede since it is much farther from Jupiter than Io, for example. Scientists have also attempted to make tidal heating a greater heat source in the past by proposing Ganymede's orbit passed through a different orbit resonance in the past that increased the tidal effects. But this research found that tidal heating was inadequate.[3] These issues have prompted scientists to look into other mechanisms that could drive a magnetic dynamo for Ganymede. The fundamental question is: how could its magnetic field last to the present, after over 4 Ga of solar system history?

Compositional convection

Recent research from planetary scientists has developed the concepts of what is called compositional convection for driving a magnetic dynamo.[4–8] When an iron core is mentioned by scientists, the word 'iron' is not usually intended to mean pure iron. It is normally assumed that an iron core consists of some pure iron and some other compound of iron, such as iron sulfide (FeS). In the outer solar system, accepted theories for the formation of the planets and moons would assume that sulfur would be more abundant in the Jupiter region than it would be near Mercury or Earth, for example. Also, iron sulfide has the effect of lowering the melting temperature of the mixture, compared to pure iron. Thus, it is proposed that inside the liquid core, after its formation, a composition gradient would form with more pure iron near the core-mantle boundary and more iron sulfide at the bottom of the core. The mantle is at a cooler temperature and so it cools the top of the liquid core. But since the bottom of the core is under greater pressure, it is hotter. The temperatures of a liquid core for an object the size of Ganymede would be somewhat lower than for a larger object such as Earth's core.

Iron sulfide is less dense than pure iron, so the above situation is unstable. The iron which is cooled near the core-mantle boundary (CMB) can crystallize as small particles (iron 'snow') and sink down toward the bottom of the core. This is the 'snow zone' shown as black in figure 2. Since the temperature increases with depth, the sinking iron 'snow' particles remelt, and this lower liquid zone is where it is proposed convection could take place. The iron sulfide rises toward the top of the core due to its buoyancy. The temperature and pressure conditions and composition of the core mixture determine how the core changes over time.

As the liquid core cools slowly over time, this leads to a growing iron 'snow' layer at the top of the core, which grows downward. Eventually the iron 'snow zone' grows to include all of the core. But while the molten layer exists, it is thought that convection can occur under the 'snow zone'. Thus, it is believed convection currents can form in the molten portion below the iron 'snow zone'. This scenario is a top-down change in the core. The lower liquid zone would eventually be replaced with the 'snow zone', consisting of a mix of solid and liquid. This would stop the convection currents, and a dynamo would stop operating.

Image: NOAA / Public Domain

Figure 1. Ganymede

Scientists have suggested Ganymede originally formed partially undifferentiated and remained that way for some time, so initially there was no iron core. Then only after heat built up later did Ganymede's core form. This would make the core a late feature, so that it does not have to have existed the entire 4.5 Ga since the alleged beginning of the solar system. One study pointed out the iron 'snow' scenario presents a problem because of the limited time required for the 'snow zone' to fill the core:

> "Such a dynamo ceases as soon as the snow zone encompasses the entire core, i.e. the dynamo lifetime is controlled by the growth of the snow zone. We find that the dynamo lifetime does not exceed 800 Myr. Thus, our study suggests that a dynamo below the snow zone in Ganymede's core must be a very recent feature."[7]

However, this difficulty does not exist in a biblical timescale of only several thousand years.

Scientists are applying the compositional dynamo concept in Mercury as well, but it works out differently. Mercury is believed to have three layers in its core, but it is thought to follow a more bottom-up change in the core where the solid inner core slowly grows.[9] Planetary scientists believe a composition gradient in the core would not endure to the present for some objects such as Mars and our moon. Thus, scientists are proposing compositional convection could explain why these objects both have remanent magnetism in rocks but no present magnetic field.

An important question for this model is: would the core of an object such as Ganymede allow for convection, or would it transfer the heat out of the core by normal conduction? If the heat is removed from the core by conduction (without convection), then a dynamo is not possible. There are effects that could prevent fluid convection in Ganymede. One difficulty with the iron 'snow' model for Ganymede is whether sinking iron particles in an Fe-FeS fluid could drive convection? There are experimental studies on fluid properties and thermodynamic properties of Fe-FeS mixtures, including some at high pressures. But planetary scientists seem to consider mostly the thermodynamics and heat conduction. The role of sinking iron particles is difficult to include into simulations and calculations. The following quote makes this difficulty clear:

> "We are not aware of any study on the convection structure of the ambient liquid induced by settling particles. In an experimental work on another topic by Blanchette and Bush … it is stated as a side note that particles settle as individuals creating no large-scale convection. Clearly, the question of whether the sedimentation of iron particles generates large-scale convection, which is necessary for magnetic field generation … remains an open issue."[7]

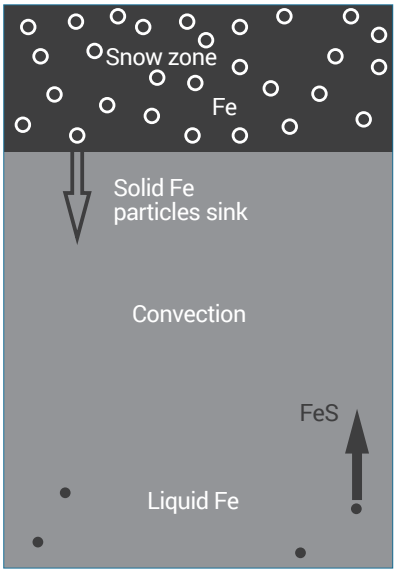

Figure 2. The core of Ganymede is shown as conceived in the top-down iron snow model for Jupiter's moon, Ganymede. Both the black and grey regions make up the core, containing a mixture of iron and iron sulfide. The black region is more solid, while the grey region is more molten, containing more iron sulfide. The black 'snow zone' grows from the top down until it fills the entire core.

Another difficulty is that the composition of planetary cores is actually not well known. Even for Earth's outer core the composition is still debated.[10,4] The proportion of sulfur is a key factor in studies of Ganymede's core. Scientists have used models with a range of possible proportions of sulfur in Ganymede's core. As the fraction of sulfur is increased, this lowers the melting temperature and allows the iron mixture to stay molten at lower temperatures. So, increasing sulfur can make convection more likely. However, if the fraction of sulfur is increased too much, it can prevent convection.[8] This is because electrical conductivity decreases with an increasing fraction of sulfur. The lower conductivity raises the temperature and leads to more heat transfer out of the core by conduction, without convection. For some iron 'snow' scenarios, calculations do produce a magnetic field of approximately the right magnitude, but they assume high percentages of sulfur over 23%, which are probably unrealistic.[8] So, planetary dynamo models still struggle to explain Ganymede possessing its own magnetic field.

A creation view

The magnetic field model of Dr D. Russel Humphreys has been more successful than old-age magnetic dynamo theories. (Other young-age creation models for magnetic fields may be possible but, to date, Humphreys' model is the only one put forward.) Humphreys applied his model to the magnetic fields of Earth, Uranus, Neptune, Mercury, our Sun, and bodies in our solar system.[11–16] Mercury is slightly smaller than Ganymede but possesses a larger iron core with both solid and liquid layers.[17,7] Humphreys' model proposed

that when God created the planets he initially made them out of water in the manner described for Earth in Genesis 1 and 2 Peter 3, "out of water".

This model has significant advantages over the old-age dynamo model. The dynamo model requires a molten conducting core such as liquid iron. It also requires convection motion of the fluid and is very dependent on the size of the core and the rate of rotation of the planet. But in Humphreys' model, the core need not actually be melted, it just needs to be a conductor. The initial magnetic field from creation decays to the present. This has been described as 'free decay' because the field decreases in intensity over thousands of years. Humphreys' model assumes a young age for the Earth and solar system and leads to realistic values for the magnetic dipole moment for Earth, Mercury, and the other planets. This makes Humphreys' model more broadly applicable than dynamo theories. Thus, it can be applied to Ganymede as well, as Humphreys has done.[15]

In Humphreys' model for the creation of magnetic fields, the exact composition of the iron core after creation is not known, but this does not create a problem in applying the model. The core's composition is estimated by interior structure models that attempt to match the overall density of the moon to gravity measurements taken by spacecraft (the *Galileo* mission). Today, Ganymede is believed to have an ice shell of roughly 200 km, then a silicate mantle of about 1,700 km, and this leaves the core as roughly 700–800 km in radius.[3,18,7] However, these are only rough approximations. If the core is smaller, it needs to have a composition closer to pure iron in order to generate the measured magnetic field. But if the core is larger, then it could have a composition more in a light element such as sulfur (in FeS). In Sohl 2002,[18] an analysis was done of the *Galileo* gravity data for the Galilean moons of Jupiter. They describe Ganymede's magnetic field thus:

> "Magnetometer measurements of the Galileo spacecraft have shown that Ganymede possesses an intrinsic magnetic field with equatorial and polar field strengths at the surface of 750 and 1,200 nT, respectively."

They go on to give a range of values on the size of the Ganymede core: "The ice shell was suggested to be about 800 km thick. The core may have a radius between 400 and 1,300 km." All these values are consistent with Humphreys' model.

Conclusions

At creation, should we assume that the composition of the core was uniform throughout? This is a simplifying assumption but not really a requirement. If there was a composition gradient in the core initially where it was closer to pure iron at the core mantle boundary but possessed more FeS at the bottom of the core, this would be unstable and so sinking iron 'snow' and rising FeS would be possible. Such a composition gradient could alter how rapidly the magnetic field decays for some period of time until the core reached a more stable uniform composition. So, to this author it seems the 'iron snow' concept is possible, but it would not drive a dynamo in Ganymede, and it would not invalidate Humphreys' magnetic model. Thus, a young-age creation perspective has real explanatory power for understanding magnetic fields of planets, moons, and other objects in space.

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Fossilized animal and bird footprints in megasequences

Carl R. Froede, Jr., A. Jerry Akridge, and John K. Reed

The naturalistic stratigraphic concept of Sloss sequences, relabelled 'megasequences' by several young-earth creationists, had limited technical development in the first few decades following its introduction.[1–3] We previously evaluated the concept of Sloss sequences (and Sloss-derived creationist megasequences) but found its application incapable of defending the biblical record of Earth's history.[4] Only recently has a more fully developed presentation of creationist megasequences been published in a book[5] and peer-reviewed journals[6–10] from which critical analyses can be offered.

Exegesis of Genesis 7 with geologic notes

Perhaps the most biblically relevant application of megasequences was published in an exegesis of Genesis 7.[10] This article applies both catastrophic plate tectonics and stratigraphic megasequences to events described in Genesis 7. We focus specifically on the problem of the stratigraphic distribution of fossil animal and bird footprints, tracks, and trackways in the megasequence model.

We applaud the authors for defending the biblical account to demonstrate the Flood was global, catastrophic, and of unparalleled destruction. The significance of Days 1, 40, and 150 to the Flood were reviewed and explained in graphic terms that are consistent with our own expectations regarding this singular event in Earth's history. We can all agree that all air-breathing terrestrial life, including birds outside the Ark, died by the 150th day of the Flood.

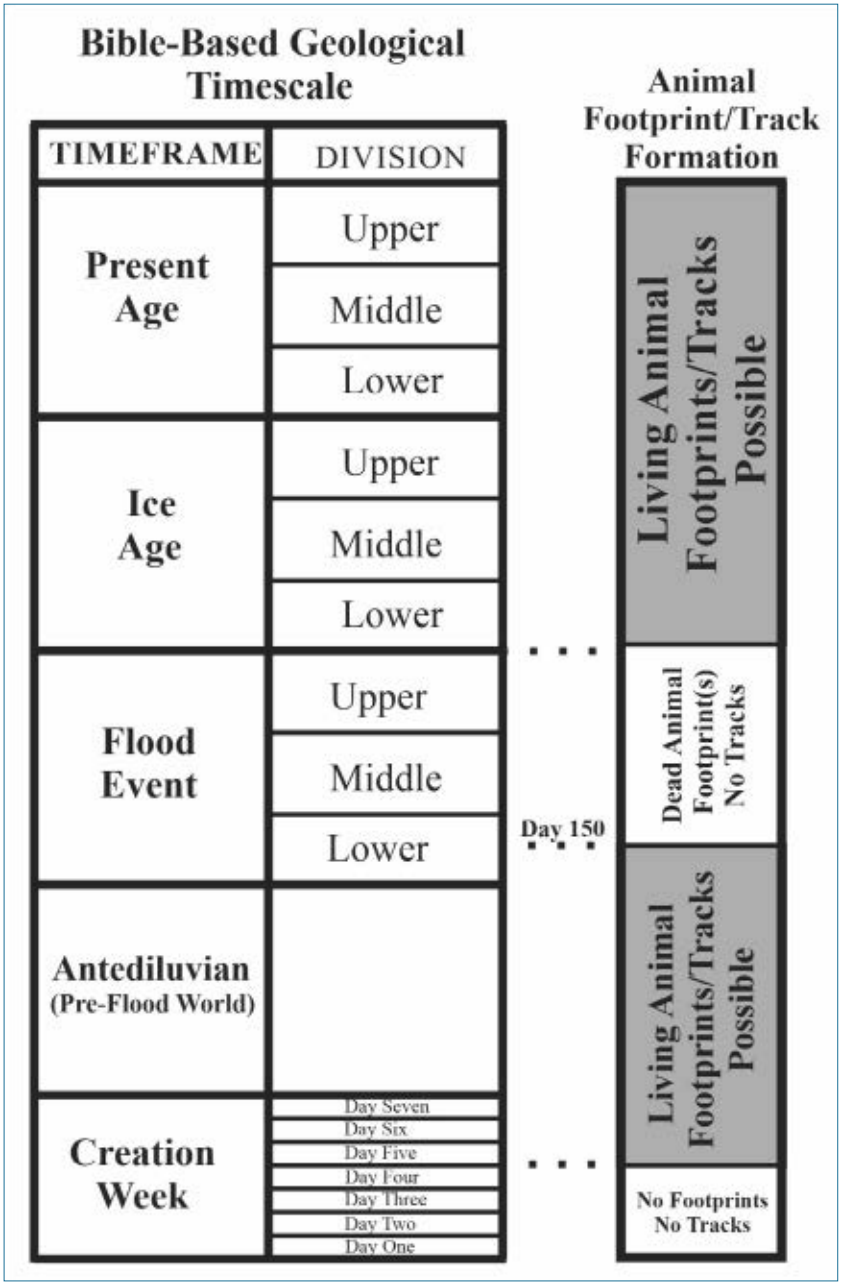

Figure 1. A Bible-based geologic timescale with fossilized footprints, tracks, and trackways defined consistent with Scripture. The termination of all living terrestrial animals in association with the global Flood of Genesis would correspond to the end of the first 150 days. Any fossilized animal/bird footprints/tracks/trackways that formed after this day would be from dead and possibly bobbing, prone creatures being carried along by floodwater. Each stratigraphic layer with footprints, tracks, and trackway impressions, whether derived from living or dead life-forms, will need to be defined within the geologic timeframes and divisions shown.

The geologic notes are broad in scope and largely lithostratigraphic with an occasional reference to fossils.[11] For example, although the mixing of vertebrate skeletons and marine fossils was interpreted across two megasequences (Absaroka,[12] and

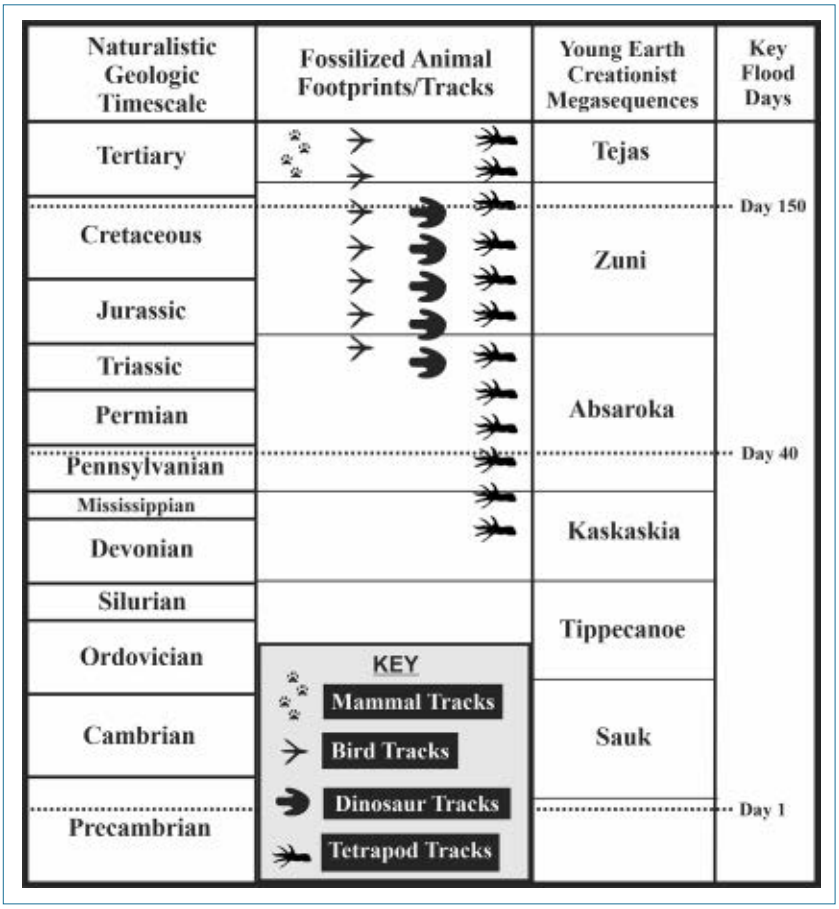

Figure 2. The dashed lines define the Key Flood Days from the exegesis of Genesis chapter 7.[42] Sloss-derived creationist megasequences cannot define fossilized animal and bird footprints, tracks, and trackways independently from the Naturalistic Geologic Timescale (NGT). Except for the dinosaurian fossilized footprints, animal and bird footprints, tracks, and trackways created by formerly living creatures occur with increasing diversity when moving from the Kaskaskia megasequence to the present time. This linear stratigraphic understanding (based on the NGT) is inconsistent with Scripture and must be rejected unless an explanation can be provided to align these traces with a biblical understanding of Earth's history.

Zuni[13]), missing was an explanation of perhaps the most important set of trace fossils—fossilized animal and bird footprints, tracks, and trackways. While floodwater can mix the remains of animals and marine fossils, rendering them allochthonous[14] deposits of limited use, the fossilized footprints/tracks/trackways of formerly living creatures must be formed *in situ*.[15] Where these fossilized features represent activities associated with past life, they would be important in discerning their formation relative to Flood Day 150.[16]

Fossilized animal/bird footprints—when did they form?

Many animal/bird lifeforms could have created footprints/tracks/trackways before the Flood. With the onset of the Flood, living animal[17,18] and bird[19–22] footprints/tracks/trackways would form in soft Flood-deposited sediment through Day 150 (figure 1). We recognize that footprints are possible following the 150th day of the Flood, based on dead and bobbing animals drifting prone along a soft sediment substrate leaving isolated impressions. However, we would expect these traces to be few in number, random in orientation, and isolated in occurrence.[23]

Sloss-derived creationist megasequences and the animal/bird fossil footprint record

The application of stratigraphic megasequences to a Bible-based outline of Earth's history should allow formerly living animal- / bird-formed footprints/tracks/trackways to provide an important biomarker. Their presence in the stratigraphic rock record[24] should terminate by the end of Day 150. The specific megasequence (moving from oldest to youngest: Sauk, Tippecanoe, Kaskaskia, Absaroka, Zuni, or Tejas) where this fossil evidence of life was terminated could then be used globally to stratigraphically approximate Day 150 of the Flood.[25]

However, an examination of animal/bird footprints/tracks/trackways defined within Sloss-derived creationist megasequences creates a puzzling situation (figure 2). There is no apparent termination of the fossils as would be expected based on Scripture. The opposite seems to be the case. More diversified fossilized animal/bird footprint, tracks, and trackways occur in moving up the megasequence timescale.[26–30] Based on these fossilized traces, life has continued to increase on Earth from the Kaskaskia megasequence to the Tejas megasequence (i.e. present time). We would be interested in understanding how those advocating megasequences would address this issue. This confusing situation with the proliferation of living animal/bird footprints/tracks/trackway trace fossils, created following Day 150, is even more pronounced when viewed through the framework of Catastrophic Plate Tectonics (CPT).[17]

Fossilized animal/bird footprints in the Tejas megasequence

As mentioned previously, the Tejas megasequence contains an abundance of footprints/tracks/trackways created by formerly living animals/birds. This is puzzling, since no living terrestrial life should exist outside the Ark during this time, when, according to advocates of the megasequence model, floodwater was withdrawing from the continents.[5,7,8] This is another issue where we request clarity from the supporters of megasequences regarding the apparent contradiction in their megasequence model and the diverse animal/bird trace fossils where none should be found.

Moving forward

The fossil record of animal/bird footprints/tracks/trackways created by formerly living creatures does not fit the Sloss-derived creationist megasequence model. They extend from the Kaskaskia megasequence to the present (top of the Tejas megasequence). These living creatures somehow left footprints in Flood deposits as evidence of their survival. They are found well past the megasequence-defined Day 150 termination of all terrestrial life, as conveyed by Scripture.[10] This problem occurs because the megasequences are inexorably linked to the Naturalistic Geologic Timescale (NGT),[5,7,8] which cannot be unified to biblical history.[31–38] The only way we believe that creationist megasequences can be properly applied stratigraphically is if young-earth creationists abandon the NGT for one aligned with the biblical narrative.[39–41] We hope the problems we have identified can be simply and easily addressed by the advocates of creationist megasequences in a way that more consistently defends the biblical account of Earth history (figure 1). We look forward to their response and resolution.

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'Ice-rafted' dropstones from warm-climate cap carbonates?

Michael J. Oard

Ice-rafted dropstones are thought to be one indication of an ancient ice age. However, they are equivocal as an indicator of glaciation, since several other processes can duplicate dropstone rhythmites.[1] Ice-rafted dropstones are not expected to occur in warm-climate sediments. However, dropstones have recently been found in a cap carbonate,[2] which is accepted as evidence of a warm climate that melted several global Neoproterozoic 'ice ages'. This has presented a conundrum for uniformitarian scientists:

> "Dropstones of ice-rafted origin are typically cited as key cold-climate evidence in Cryogenian strata [from the Neoproterozoic] and, according to conventional wisdom, should not occur in postglacial warm-water carbonates."[3]

What are cap carbonates?

Cap carbonates are found above 'glacial deposits' of most of several Neoproterozoic 'ice ages'. These 'ice ages' are mostly considered global ice ages because the evidence for them is found in marine strata at low paleolatitudes based on paleomagnetism.[1] Cap carbonates especially cover the Marinoan 'ice age' all over the world and sometimes the Sturtian 'ice age' of the Cryogenian.[4] They can be up to several tens of metres thick.[5] Cap carbonates cover 45,000 km^2 in the Neoproterozoic glaciation from the Adelaide Rift.

The cap carbonate above the 'glacial' Chuos Formation

The Chuos Formation, in Namibia, is considered to be deposits from an ancient Neoproterozoic ice age. Above it is a cap carbonate that "is

Figure 1. Stones in tree roots from a toppled tree in the northern Tobacco Root Mountains, Southwest Montana, USA.

interpreted to record the abrupt change to a significantly warmer greenhouse climate."[3] The Chuos Formation is marine, based on the presence of foraminifera fossils. The researchers postulate that the occurrence of dropstones in a warm-climate rock was caused by 'vestigial glaciation', probably meaning glaciation from some distant land in which icebergs floated over the warm water. The 'dropstones' do appear to have been dropped from above:

> "Most lonestones [isolated dropstones] exhibit both impact structures beneath them and draping laminations (undisturbed dololaminae) above them."[6]

The Chuos Formation has bounced back and forth as originating either from glacial ice or non-glacial mass flow. Eyles and Januszczak concluded that the Chuos Formation is entirely a mass flow deposit.[7] It is interbedded with other mass flow sediments, such as conglomerates and sandstone turbidites. Le Heron *et al*. acknowledge the presence of mass flow sediments, but they also believe that the formation is glacial,[2] probably because of the presence of dropstones that they think can only be carried by ice (see below).

Most cap carbonates are cap dolostones

The cap carbonate is supposed to have formed in a warm climate. This is supported by the fact that most of the cap carbonates are *dolostone*. Primary dolostone, and even replacement dolostone, requires water temperatures greater than 100°C.[8,9] Previous to this, no dropstones had been found in cap dolostone:

> "This finding [dropstone dolostone] is significant, because 'no convincing dropstone has been confirmed from cap dolostone units anywhere in the world' (Shields, 2005, p. 301)."

The comparatively hot temperatures required for the deposition of cap dolostones are a good indication that the supposed glacial deposits are not really glacial. The evidence for glaciation, including supposed glacial indicators, can be explained by gigantic submarine mass flow during the Flood.[1] Mass flow can mimic all the glacial indicators for ancient glaciations. In support of this, part of the cap dolostone itself shows evidence of mass flow.[2]

Belief in evolution eliminates all dropstone mechanisms except for ice rafting

Probably the primary reason that Le Heron *et al*. still believe the Chuos Formation is glacial and that the cap dolostone represents vestigial glaciation is that they cannot think of a mechanism, other than from ice, for dropstones in the Neoproterozoic. This belief is based on evolution, in which there would be no seaweed, such as kelp, to explain dropstones in the Neoproterozoic.

Dropstones from the Genesis Flood

When the Creation and the Flood are considered, and realizing that the Neoproterozoic is very likely early Flood rocks,[10] it opens the door for other explanations. Eyles and Januszczak even considered such floating stones in the cap carbonate as evidence of mass flow.[7] Other aspects of pre-Pleistocene ice ages—rocks of various sizes in a fine-grained matrix, striated pavements, striated and/or faceted rocks, and other supposed glacial indicators—can be explained by gigantic submarine mass flow during the Genesis Flood.[1] But, in the Flood, trees and kelp would have existed from the beginning and, therefore, the stones could have been dropped from floating tree roots (figure 1) or kelp torn up during the Flood.

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The Parallel Roads of Glen Roy

Lucien Tuinstra

In the Highlands of Scotland there is a valley in the Lochaber area called Glen Roy—Scottish Gaelic: Gleann Ruaidh[1]—with some intriguing natural features (figure 1). Several horizontal 'roads' have seemingly been cut into the metamorphic rock of the hillsides surrounding the valley at different levels. Properly understood, these features are well explained by considering the single Ice Age that followed the global Flood, within the biblical framework of Earth history.

It is not uncommon for fascinating natural phenomena to be associated with a legendary story, folklore, or a fairytale. This is the case with the Giant's Causeway (there is a clue in the name), which is found on Northern Ireland's north coast. A related columnar basalt outcrop is seen on Scotland's Isle of Staffa, famous for Fingal's cave. In local myth, the constructor of the causeway that originally ran all the way between the two sites was Fionn mac Cumhaill (from which Fingal is derived[2]), so his feet could stay dry! This same Fingal was also said to have been responsible for constructing the Parallel Roads of Glen Roy.

Relief

Clearly visible throughout the Glen Roy Valley are three parallel embankments at different elevations (figure 2). They are approximately 10 m wide, extend for tens of kilometres, and are commonly referred to as 'parallel roads'.[3] These level 'roads' are reminiscent of contour lines (also called iso-lines), which connect points of the same altitude on a map. Such features are not restricted to this area, but also exist elsewhere in the world. However, they are very obvious in Glen Roy.

Deep time story

In the 19th century, the Parallel Roads were thought to mark previous shorelines of the sea, with the water being at much higher levels. This thinking was promoted by Charles Darwin (figure 3).[4] Darwin eventually conceded that his idea was incorrect. Louis Agassiz proposed that these Parallel Roads were indeed shorelines; lake shorelines. He ascribed the Parallel Roads to sequential ice-dammed lakes during the last glaciation.[5] According to this idea, the encroaching glacier blocked the valley, supposedly starting around 12,900 years ago. More and more ice choked the valley, thus forcing the water to rise to higher levels, until it reached a natural drainage point somewhere further up the valley. Accordingly, these ice dams caused the Parallel Roads to form at elevations of 260, 325, and 350 m respectively, before melting about 11,500 years ago and so draining the reservoirs they were holding back.

Problems of an advancing ice dam

Within this explanation, the glacier *advanced* over a period of up to 1,400 years,[6] although the timescales differ somewhat depending on who is doing the telling.[7] According to a 2010 paper from the *Journal of Quaternary Science*, the first lake formed during stage 1 (supposedly lasting 192 years), where the Spean Glacier ice plugged the normal outlet of Glen Spean to the southwest, forcing the water instead to flow out of Glen Spean northeastwardly at 260 m altitude. The second, higher, lake grew during stage 2 (supposedly lasting 112 years) as the ice formed a barrier now at the bottom of Glen Roy, forcing the water to build up and then drain through a col (i.e. valley) in an easterly direction into Glen Spean at 325 m altitude. When stage 3 commenced, this 325 m drain was closed off by the advancing ice, and the next natural drain was 25 m higher, at the northeast end of Glen Roy itself. This caused a lake to form with a shoreline at 350 m. During stage 3, the maximum height of the ice was reached, and a turning point ensued (due to rising temperature towards the end of the Younger Dryas)[8], causing deglaciation to begin. From then on, the ice retreated. Stage 3 lasted 116 years before enough ice had melted, so that the lowest drain point was back at 325 m. Stage 4 then took 96 years before it melted back to the 260 m drain level. This series of changes totals 516 years. Thereafter, further deglaciation occurred, opening up the natural spillway to the sea on the west coast.

This report in *Quaternary Science* is all well and good, but a few questions arise.

First, are the stages long enough for shorelines to form in metamorphic rock?[9] Probably.

Second, is it likely that the formed shorelines at the three respective levels would stay intact while submerged as the water rose further? Maybe. However, even if being submerged would not blur them, then it seems likely they would be destroyed by the advancing glacier ice. Various models in secular thinking show the ice advancing at higher elevation than parts of the shorelines themselves. Glaciers do not leave 'steps' in their embankments. Rather, they powerfully pluck and abrade valley sides.[10] Glaciers eventually form U-shaped valleys.

The Bible explains it well

Biblical creationists have concluded that there was a single Ice Age following Noah's Flood. The associated volcanic activity (implied by the "fountains of the great deep", Genesis 7:11) had two major consequences. First, it warmed the ocean water, greatly increasing evaporation. Second, it

Image: Google; Landsat / Copernicus

Figure 1. Glen Roy, Scotland

Image: Richard Crowest, Wikimedia / CC BY-SA 3.0

Figure 2. Parallel 'Roads' clearly visibly on the frosty grounds of Glen Roy (the red arrows have been added to clarify their location)

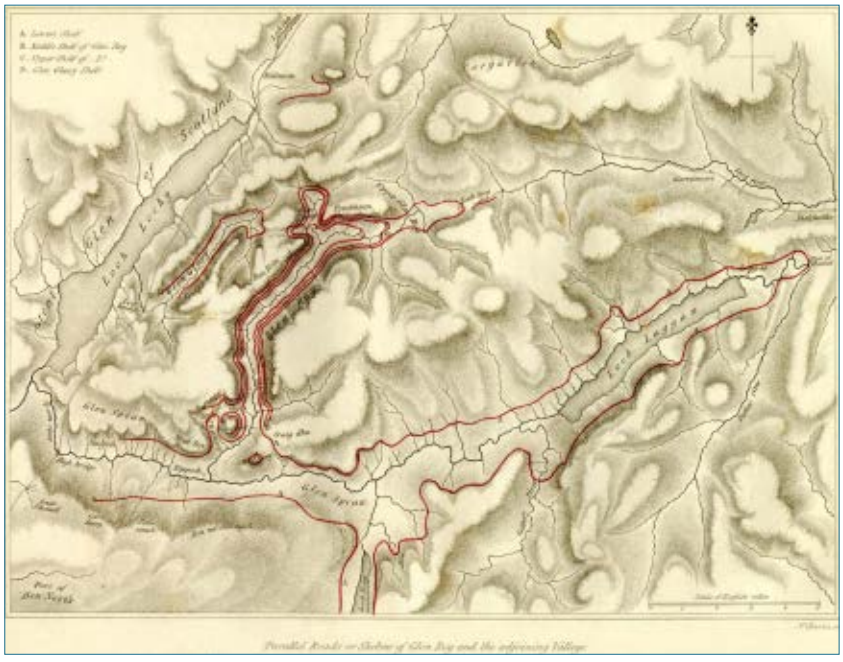

Figure 3. Darwin's map of Glen Roy displaying the 'Roads' in red (From Darwin,[4] p. 39).

produced heavy emission of aerosols, blocking sunlight and causing cold land surfaces. Unlike secular thinking, which does not have a satisfactory model for the onset of any of their proposed ice ages, the biblical model *can* explain how the single Ice Age developed (and stopped).[11,12] "The Ice Age was roughly 700 years long, taking some 500 years to build and 200 years to wane."[13]

During the declining portion of this single Ice Age, lakes would indeed have formed behind glaciers—which then acted as ice dams. When the volcanic aerosols started to disappear from the atmosphere, rising temperatures in summer would have caused the ice to melt. At lower altitudes the water could drain away to the sea, but in some higher places water pooled between the valley sides and the glacier ice dam that remained.

As meltwater accumulated and the ice dam shrank due to increasing temperature, the lake would have started to spill over and gouge a spillway by further weakening and breaking off chunks of ice. The destructive force of the water draining from the lake would have diminished due to decreased pressure as the water drained out. This would have continued until the ice had receded far enough for the next col to be exposed. Then the water would have escaped there, settling at this level and forming a shoreline. This shoreline would have been maintained until further melting repeated this stepwise process to the next lowest col. Every time the lake settled for any length of time, another 'road' (shoreline) would have been made; the result is these Parallel Roads spaced at distinct levels, as is observed today. The last lake, at the 260 m level, may have drained catastrophically.

So, instead of the lowest 'parallel road' being formed first and the highest last, it is far more likely to have been the other way around. Also, all of this happened at a much shorter timescale than the alleged 516 to ~1,400 years. Rather, in keeping with the biblical

model for the Ice Age, it would have been approximately two centuries.

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Uniformitarian paleoaltimetry estimates questionable

Michael J. Oard

Conclusions about paleoenvironments, based on the rocks and fossils, are often tenuous. Scientists frequently use terms like 'lacustrine', 'marine', 'fluvial', 'deep water', or 'shallow water' to describe local/regional paleoenvironments. They also claim they can determine the paleoclimate. All these paleoenvironmental deductions are almost universally dependent upon strict uniformitarianism. While some paleoenvironmental deductions are likely correct, such as that a marine fossil implies it came from a marine environment, others require awareness of the scientists' assumptions, and we need to evaluate their deductions accordingly.[1] Analysis often reveals contradictions among uniformitarian paleoenvironmental deductions, surprisingly even when assuming present processes.[2] One of these paleoenvironmental deductions is the paleoaltitude.

Paleoaltitude can answer other questions

One of the main reasons that uniformitarian scientists desire to determine the paleoaltitude is because they believe a multitude of deductions can flow from those estimates. From them, scientists claim they can calculate many things, such as:

- the timing, mechanisms, and dynamics of uplift
- changes in atmospheric carbon dioxide as a result of weathering
- how high elevations can be sustained for millions of years
- how elevations affect climate
- whether planation surfaces were carved at sea level or above sea level, and
- the origin of deep gorges.

Researchers especially like to apply paleoaltimetry to the Tibetan Plateau, the Andes of South America, and the Rocky Mountains and Colorado Plateau in the southwestern United States. They seek to understand when the Colorado Plateau uplifted so that they can time the origin of Grand Canyon, still unexplained by uniformitarian geology.[3]

Many methods for estimating paleoaltitude

Scientists have used many different methods to estimate paleoaltitudes. They are all questionable and give ranges of 0–5 km for the mid-Cenozoic, assuming the geological column: "A diverse suite of techniques, each with their own biases and uncertainties, yield discrepant mid-Cenozoic elevations estimates (0–5 km)."[4] Biases include incomplete or selective sampling: "Finally, we posit that interpretations of proxy data can be incomplete or selective sampling."[4]

The chaos of suggested paleoaltitudes, based on the diversity of approaches, is especially obvious in the discussions trying to explain the uplift of the Tibetan Plateau.

Uplift of the Tibetan Plateau

The major question is: when did the Tibetan Plateau uplift in the Cenozoic? Ingalls *et al*. apply several methods to the history of uplift and peneplanation (the forming of a rolling planation surface) of the Tibetan Plateau.[5] They obtain early- to mid-Cenozoic high elevations for the Lhasa Terrane of the Tibet Plateau (figure 1). The Tibetan Plateau is believed to have been formed by the accretion of

several generally east–west continental terranes to southern Asia. This they say happened during the Mesozoic collision of the Indian Plate before India itself supposedly slammed into the terranes in the early Cenozoic. The Lhasa Terrane is the first terrane north of the Himalaya Mountains. However, some studies claim that the Lhasa Terrane was already high before the Cenozoic and the continental collisions.[5]

Researchers often use the strata in basins on the top of the Lhasa Terrane to make paleoaltitude estimates. These basins contain 'fluvial-lacustrine' sedimentary rocks. Researchers have used paleontology, palynology (pollen abundances), and geochemistry of these basins to determine paleoaltitude. The Lunpola basin has 4 km of strata they claimed was deposited from the Eocene to Pliocene.[6]

Paleontological and palynological methods

One method is to use the environments and altitudes occupied by the nearest living relatives (NLRs) of the basin fossils, assuming present climate conditions. This method gives low to intermediate altitudes ranging from sea level to 3 km in the Oligocene.[7] The NLR method is questionable, especially because secular scientists claim a supposedly warmer and drier paleoclimate at that time, and the area was at a different paleolatitude.

Late Eocene marine foraminifera have been found in a basin on the northern Lhasa Terrane.[8] Since foraminifera are marine, and the fossils are presently high altitude, far from the ocean, Wei *et al.* suggest that ancient oceans were close to the Tibetan Plateau in the late Eocene. So, they postulate the nearby 'Himalaya and Pamir Seas' with the foraminifera blown inland by storms when the paleoaltitude was low. Because many studies indicate a high altitude near the 'time' the foraminifera supposedly lived, the discoverers claim that the paleoaltitude started low and rapidly uplifted.

The use of palynology also yields different results.[7] Pollen data can be gleaned from the paleoaltitude or the paleoclimate. Thus, palynological and paleontological data can be equivocal.

Geochemical methods

Oxygen and hydrogen isotopes are often used for paleoaltitude estimates but are based on present-day relationships, such as an isotopic decrease with the altitude, but this likely would not apply to the past. Wei *et al.* claim that more positive oxygen isotope ratios can support a low altitude of the Tibetan Plateau in the late Eocene, reinforcing the evidence from foraminifera. However,

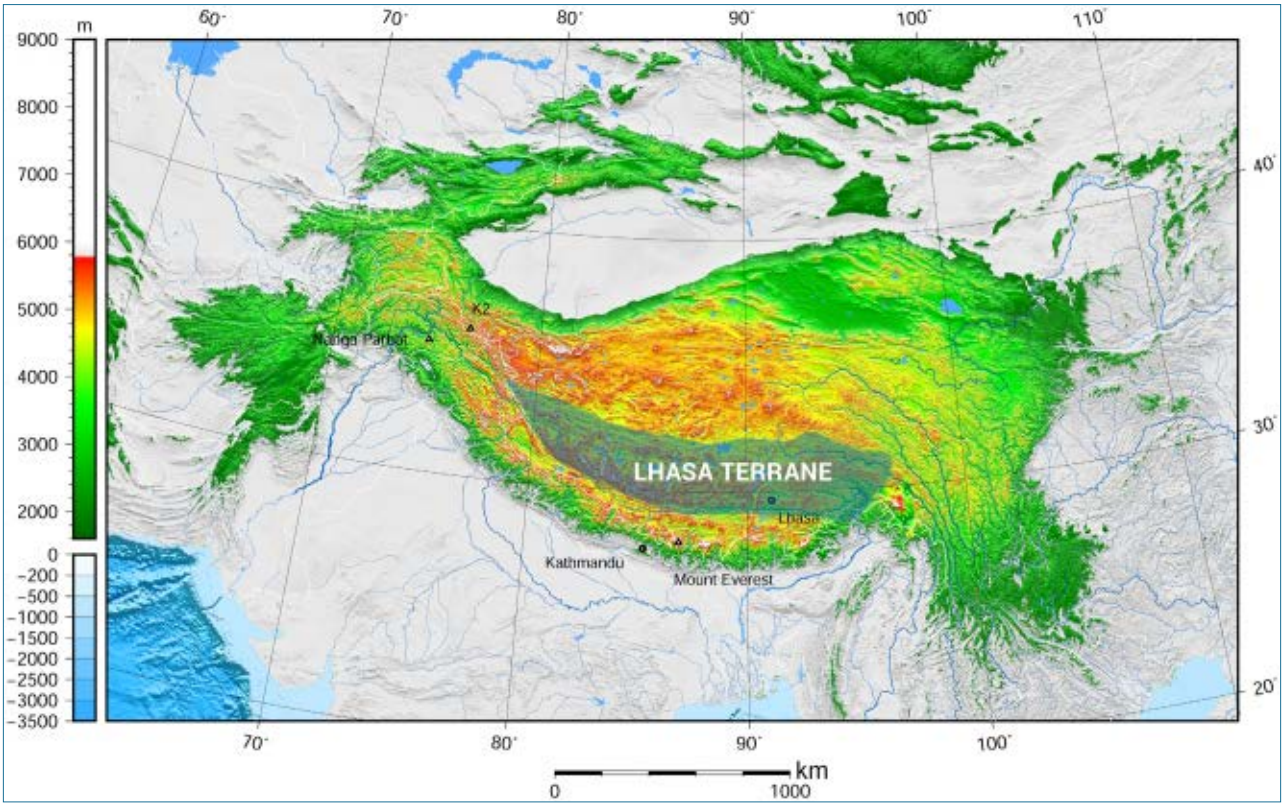

Image: Darekk2, Wikimedia / CC-BY-SA-4.0 (modified)

Figure 1. The Tibetan Plateau colour-coded to altitude with the Lhasa Terrane drawn in

it is known that evaporation and diagenetic changes can alter the primary isotope signals.[9] Furthermore, even today several variables affect the isotope measurements.[10] So, different paleoaltitudes of the Tibetan planation surface have resulted from the oxygen isotope ratios.[11]

One recent report claimed oxygen isotope ratios gave a low Eocene elevation (< 500 m above sea level) for the plateau, in line with paleontological and paleobotanical proxy data.[12] Supporting low elevations are tropical paleoflora, such as palms, golden rain trees, and climbing vines found and dated to the Oligocene.[13] Other oxygen isotope results had given a present-day elevation for the Tibetan Plateau in the Eocene.

Botsyun *et al*. countered that these results are in error because the usual decrease in $\delta^{18}O$ with height did *not* apply, and the ratio actually increased with altitude during the Eocene. This would falsify all the previous isotopic paleoelevation results that gave high elevations. Botsyun *et al.* also contended that the complexity of all the paleoenvironmental changes requires a 'climate simulation' to interpret the data:

> "The complexity of atmospheric processes within greenhouse climates, combined with differing paleogeographies, highlight the necessity of using dedicated climate simulations for interpreting $\delta^{18}O_c$ data."[14]

Of course, climate simulations can also be subjective, especially when setting the initial conditions. In this case, Botsyun *et al*. postulate a 'Paratethys Sea' near the location of the Lhasa Terrane and northward that would greatly affect oxygen isotope ratios in the mid Cenozoic. Others have challenged the Botsyun *et al*. results, stating: "However, we contend that their conclusions are flawed as the result of a number of failings of both the modeling and the data comparison."[15]

Ingalls *et al*. also challenge the results of Botsyun *et al*. and compute a high Tibetan Plateau in the Eocene. Ingalls *et al*. not only used carbon and oxygen isotopes, but also the newer temperature proxy of carbonate clumped isotopes. They get Eocene paleoaltitudes of 3.1–4.7 km, much higher than those of Botsyun *et al*. But their analysis also depends upon many assumptions with complex proxies.

So, on it goes with contradictory conclusions. Like previous researchers, Ingalls *et al*. are dogmatic about their high paleoaltitudes for the Tibetan Plateau in the Eocene:

> "Using carbonate clumped isotopes and stable isotope paleoaltimetry, we determined that the mean elevation of the northern Lhasa terrane has been in excess of 3.1 km above sea level since at least the Eocene."[16]

But one thing is certain, at least some paleoaltitude proxies conflict and produce variable results.

What does a high Cenozoic Tibetan Plateau mean for peneplanation?

The paleoaltitude of the Tibetan Plateau has consequences for the planation of the Tibetan Plateau. This planation surface is about 2.5 million km^2 in area and has been subsequently dissected by gorges kilometres deep. At the large scale, the Tibetan Plateau is extremely flat: "Concerning the first factor, at moderate to long wavelengths from tens to hundreds of kilometers, central Tibet is extremely flat."[17] It is interesting that Ingalls *et al*. use the old rejected terminology of William Morris Davis and call the Tibetan Plateau a peneplain. I have noticed other researchers have also been using this same old terminology when writing about planation surfaces.

Since Ingalls *et al*. claim high paleoaltitudes in the early Cenozoic, they would place the formation of the huge planation surface at well above sea level. Other researchers also believe the planation happened at high altitude.[18,19] Sea level has normally been called the 'base level' for planation surfaces.[20] This is reasonable from a deep time point of view, since erosion will ultimately reduce a high terrain to sea level. However, it is still difficult to account for local and regional bevelling of many different lithologies down to a flat surface.

One suggested mechanism for creating a high-altitude planation surface is the glacial buzzsaw or cryoplanation. This is the idea that glaciers and periglacial activity can form flat surfaces. This mechanism can apply for local areas, such as ridge summits, but such low-gradient features are scattered and small.[21] Furthermore, glaciation cuts valleys and does not plane laterally.[22] Another problem for Tibet is that, except for the mountains, the Tibetan Plateau was never glaciated.[23] A recent hypothesis for southeastern Tibet is that stream piracy somehow formed the narrow planation surfaces between three parallel rivers within 3–4 km deep canyons.[18,24] This, too, has numerous problems.[25]

Flood interpretation

Applying a Flood model, the Himalaya Mountains and the Tibetan Plateau rose up out of the floodwater during the Recessive Stage of the Flood.[26–28] Sedimentation and erosion of the Tibetan Plateau would have taken place underwater, before uplift. Because of this, we would expect equivocal paleoaltitude proxies. Proxies need to be accurately dated, so part of the problem could be the inaccuracies of the various dating methods.

Planation likely occurred when kilometres of sediment were eroded, during the runoff of the Flood. Uniformitarian scientists estimate 10 km of erosion at one location of

eastern Tibet, based on fission track thermochronometry.[29] But this method also is loaded with uniformitarian assumptions, such as past subsurface temperatures and deep time. Since the top of the Tibetan Plateau is mostly igneous and metamorphic rocks, the planation could have occurred early in the Flood as part of the Great Unconformity. But I favour planation during Flood runoff because of the great thickness of conglomerate at the base of the Himalayas.[30] During uplift and Flood runoff, the planation surface would have been deeply dissected as the flow became more channelized. Block faulting was happening at much the same time, resulting in deep rifts and basins, as well as uplifted mountain ranges that tower above the average elevation of the plateau.

All the geologic activity revealed on the Tibetan Plateau points to a Flood/post-Flood boundary in the late Cenozoic, assuming the geological column. In support of this is 3–6 km of rock claimed eroded from the Tibetan Plateau,[19] and deep basins on top of the plateau, one of which has 4 km of Eocene to Pliocene sediments. These features indicate massive erosion and deposition happening into the late Cenozoic, probably under the floodwater, indicating a very fast late Cenozoic uplift, if the dates can be trusted. If the Cenozoic was deposited after the Flood, we are left with explaining how this enormous amount of geomorphological activity could have happened after the Flood.

Conclusion

Many uniformitarian scientists present their results with certainty, while other researchers claim they are flawed. Dogmatism seems to be characteristic of much secular historical science. But that dogmatism can reveal a genuine conflict in the datasets secular investigators are working with that is much simpler to explain in the context of Noah's Flood. Paleoaltimetry proxies are a case in point.

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A floating island with growing trees and monkeys observed

Michael J. Oard

Both uniformitarian and creation scientists find it challenging to explain how plants and animals migrated to where they are today other than by land bridges and simple migration.[1] Uniformitarian scientists at one time thought, against all odds, that many of these organisms had to have rafted long distances on vegetation mats that were ripped up during storms. Then, when plate tectonics was accepted in the 1960s and 1970s, they thought their biogeographic difficulties were solved. The organisms could simply have ridden the plates to their destinations. However, further analysis has shown that plate tectonics, the vicariance theory,[2] would work for only a few organisms. Outstanding examples that necessitate rafting include finding various similar mammals in both Africa and Madagascar and monkeys and rodents that somehow made the trip from Africa to South America.[3,4]

Uniformitarian challenges to vegetation rafting

However, rafting also brings up numerous challenges. Some researchers say it is 'impossible'.[5] Other than anecdotal tales from four sailors reported in newspapers between 1902 and 1924 collected by Van Duzer,[6] there are no observations of mammals on floating islands at sea.

However, there are numerous floating islands in bogs, wetlands, lakes, and rivers. Most of these floating islands are created by mosses that reach out from the banks and then break off. Nonetheless, the example of lizards being swept off one Caribbean island by a hurricane to a nearby island on a vegetation mat[7] is a trivial example. The rafting of mammals, with their high metabolic rate and resource requirements (and, for many mammals—large size), appears to be the most difficult problem for biogeography.

Mazza *et al*. list many variables that *all* must be satisfied for a successful colonization over water, but they can be grouped into three main considerations: (1) biological variables (table 1), (2) characteristics of the vessel (table 2), and (3) physical variables (table 3).[4] Nonetheless, these variables do not exhaust the issues.

To colonize a faraway land, there must be enough interfertile animals on the rafts. Just considering the vessel, it must be able to provide enough food and fresh water, be capable of staying afloat until it reaches the new location, and be carried by the right currents. Natural rafts that have all these characteristics have never been observed. It also has been noted that floating islands descending to the ocean from rivers are quickly broken up by waves.[5] If a floating island reached the open ocean, it would not last long. Mazza *et al*. summarize the many difficulties:

> "Nonetheless, given the many complex, intricate and interdependent variables involved in over-sea dispersal of terrestrial mammals, the probability that they could reach remote islands by this means [vegetation rafts] appears vanishingly small."[8]

Although admitting to many challenges of vegetation rafting, especially for mammals, Ali and Vences shoot back that such oceanic rafting is still possible and that the alternative of short-lived land bridges suggested by Mazza *et al.* would have to be miraculous.[9] Ali and Vences suggest that for small mammals, large, uprooted trees and vegetation mats could have carried food, and that water might have come from high precipitation in rain belts. Regardless, as improbable as rafting seems to be, it is the only uniformitarian possibility.

Table 1. Biological variables listed in Mazza *et al.*[4] for successful rafting

Biological Variables
1. Starvation
2. Dehydration
3. Temperature and humidity
4. Salt intake

Table 2. Characteristics of the vessel needed for successful rafting of organisms, from Mazza *et al.*[4]

Characteristics of the Vessel
1. Provide the needed resources
2. Large enough
3. Shaped to minimize drag through the water

Table 3. Physical variables needed for successful rafting, from Mazza *et al.*[4]

Physical Variables
1. Wind and currents favourable
2. Problem of ocean eddies
3. Problem of tsunamis and storms

Floating islands with trees and monkeys now observed

There are numerous small floating islands on isolated water bodies adjacent to the Magdalena River of northwest Columbia.[10,11] The rafts are composed of aquatic plants, bound together and floating. As the floating islands grow, they can support large woody vegetation such as vertical trees. These floating islands typically are 30 m long, but some are greater than 100 m long. One floating island was observed to have trees up to 10 m tall and monkeys on the limbs. Theoretically, as the river

Figure 1. A plant growing from the top of a piling along the Columbia River, Portland, Oregon, USA

floods, it could pick up one of these floating islands and send it down river to the ocean, where it could even float for a distance on the ocean. Apparently, ocean travel has not been observed. Still, the authors believe this observation provides potential for explaining cross-ocean transport.

A more viable creation science explanation

Despite the new observation, the evidence still suggests that the uniformitarian ideas of vegetation rafts and short-lived land bridges are very unlikely. For one, the rafts would be too small, assuming the vegetation was ripped up by a storm, deposited in a river, and carried to the ocean. Then there are the numerous other challenges presented by Mazza *et al.*[4] listed in tables 1–3.

Creation scientists have a much better option for explaining biogeography. First, the rafts of logs and vegetation are a result of a violent global Flood, so they do not have to drift down a river to the sea, but would already be floating on the oceans.[1,12] Based on the estimated amount of coal, it is likely that the pre-Flood biosphere had about 10 times the amount of carbon, which could translate into 10 times the number of plants and trees compared to the present earth.[13] Although masses of this vegetation were deposited within the sedimentary rocks,[14] much of it would have continued to float on the oceans after the Flood. These logs and vegetation mats could be extensive and thick and last many years.[15] They should be able to transport small animals, and possibly relatively large animals, across water bodies. The ocean currents and winds during the Ice Age would have been different than they are today. Although we do not know these variables, we are not constrained to explain biogeography by the present-day water currents and wind patterns. Moreover, there was much more rain during the early- to mid–Ice Age,[16] so that the need for fresh water on the log mats would not necessarily have been a problem. It is likely plants and even trees grew on these post-Flood floating islands, providing food for animals. I have observed plants growing on wood pilings (figure 1), so the same thing could occur on the floating islands.

Conclusions

The recent observation of 'floating islands' large enough to support trees and monkeys provides interesting support for the biblical framework of animal dispersal after Noah's Flood. Current long-age theories of biogeographical dispersal struggle to explain how rafting across oceans could be viable. However, the Flood would have provided much fodder for the formation of large floating vegetation mats akin to modern 'floating islands', but much larger, potentially enabling them to survive trips even across oceans.

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William Stukeley, and an early 18th century plesiosaur

Andrew Sibley

William Stukeley (or Stukely) (1687–1765) was born in Lincolnshire, trained as a doctor, then as an Anglican cleric, and became a keen and accomplished archaeologist (figure 1). He is sometimes considered the father of archaeology and was also committed to defending the biblical account of creation and the Flood in the early 18th century. He was opposed to both deists and atheists through his studies and research. He rose to become a member of the Royal Society, where he was acquainted with Sir Isaac Newton, and was the first secretary of the Society of Antiquaries of London (from 1718). It was in fact Stukeley's memory that recorded Newton's anecdote about a falling apple and the theory of gravity.[1]

From 1703 he had a broad education at Cambridge University, which included ethics, divinity, classics, mathematics, and philosophy. Spare time involved collecting Roman coins, fossils, and other artefacts. Then greater focus was placed on medicine in 1709, training at St Thomas hospital in London, before starting a practice in the Lincolnshire town of Boston less than a year later. Through travels around Britain between 1710 and 1725, he visited various Roman sites, and earlier Celtic ones, which he ascribed to the Druids. He described the sites though a series of notebooks, including the stone circles at Avebury and Stonehenge. Some of this was written up in such works as *Itinerarium Curiosum* in 1724.

Financial struggles may have played a part in his desire to redirect his vocation to that of an Anglican cleric, gaining ordination in 1729 with the help of his friend, Archbishop of Canterbury William Wake. He later stated that it was for the purpose of challenging deism; to "combat the deists from an unexpected quarter",[2] and responded to Wake that he saw his duty to counter the "profaneness and infidelity that prevails so much at present, and threatens an utter subversion of religion in general."[3] Wake saw in Stukeley a useful ally in the struggle to uphold the orthodox faith.[4] Deists tended to be sceptical of scriptural revelation, and believed it possible to know God through reason and scientific evidence alone—i.e. through the design argument. Within deism, there was a move to reject the doctrine of the Trinity, and deity of Christ, which led to the growth of Unitarian churches.[5]

Despite his commitment to orthodoxy, Stukeley was very much influenced by Newton, and perhaps overlooked Newton's own Arianism.[6] Newton had believed that in his work he was only rediscovering a more ancient knowledge, and this inspired Stukeley to look for evidence of that knowledge among the early Britons. However, Stukeley saw that ancient knowledge through the eyes of trinitarian faith; the Druids, he thought, were already proto-Christians and believers in the Trinity when the first evangelists came to the British Isles.[7]

Stukeley's 'crocodile'

In late 1718 Robert Darwin of Elston (Charles Darwin's great grandfather) obtained a limestone slab, which contained a significant fossil (figure 2). The rock, a blue/grey Jurassic limestone, was thought to have been sourced from a quarry near Fulbeck, in Lincolnshire. This is the same Liassic layer that runs northeast from West Dorset, across the Cotswolds and English Midlands, to Lincolnshire and Yorkshire. Subsequently, this limestone slab was used as the platform for a well by Rev. John South, located at the Rectory in Elston, near Newark, Nottinghamshire.

Figure 1. Portrait of William Stukeley, by Richard Collins (c. 1728/1729), located Society of Antiquaries of London, Burlington House

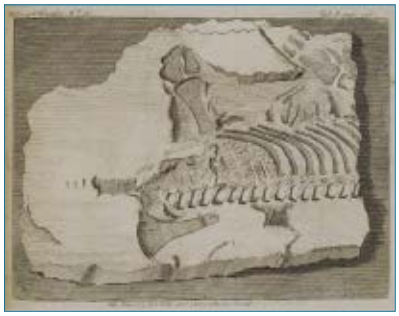

Figure 2. Drawing of the fossil plesiosaur by William Stukeley 1719. The slab of rock was 3 feet long and 2 feet 2 inches wide (approx. 0.9 m x 0.7 m).[9]

The fossil was brought before the Royal Society on 11 December 1718. A meeting, chaired by Newton, was arranged in early 1719 for a formal discussion. Robert Darwin had thought it was a human skeleton, but the members, including Stukeley, considered it

Figure 3. Drawing of plesiosaur (*Seeleyosaurus guilelmiimperatoris*)

to be of marine origin. Stukeley wrote that it was a considerable rarity, "the like whereof has not been observ'd before in this island", and that it was either a "*Crocodile* or *Porpoise*"—at this time the plesiosaur was unknown to science (figure 3).[8,9] A crocodile fossil had previously been found in Germany and a copy of the report made available to the Royal Society, which was used by Stukeley to support his claims about this latest find. It was some one hundred years later, in 1823, when Mary Anning found a near complete plesiosaur in the Jurassic layers around Lyme Regis, Dorset. Her find was described by William Conybeare in 1824,[10] and this helped scientists clarify the earlier find from Lincolnshire (it is now in the Natural History Museum in London as *Plesiosaurus dolichodeirus* (R1330)).

The incomplete find, from the Lincolnshire quarry, was carefully described by Stukeley: said to contain 16 vertebrae with intermediate cartilage, nine ribs, whole or in part from the left side, an ileum and os sacrum, and two displaced thigh bones. Several other bones were present from the right forelimb, which he described as part of a foot with several toes present. The fossil he considered to have been buried with the Noahic Flood. He wrote:

> "… and so great a Confirmation of what I had the Honour to present to the Royal Society, in a late Discourse, where I hinted at a Solution of some obvious and remarkable Phaenomena, in the external Face of the Globe, consequent to its Formation, as set forth in the *Mosaic* Account; and of some Changes it suffer'd at the universal *Cataclysm*, and Proofs of that great *Catastrophe* of the animal and vegetable World in Plants, Shells and Parts of living Creatures found in Rocks and Quarries."[9]

Stukeley believed the find had become encased in the hard rock as a result of the events of the Flood, with the limestone hardening after burial. He commented further on the recessional aspect of the Deluge, with water draining into the North Sea, which trapped the animals along the line of the Lincolnshire hills. The work of fossilisation was discussed with processes known in the early 18th century.

Conclusion

This description is noteworthy in that it shows that leading members of the British Royal Society at this time upheld the biblical Flood and were willing to use it for the purposes of scientific explanations. This was at a time when there was pressure from deists and atheists. For example, one leading French academic, Bernard de Fontenelle, the secretary of the Royal Academy of Sciences in Paris, was undermining belief in the biblical Flood through his position.[11] However, through such men as Stukeley, the Royal Society continued to take the Noahic event seriously, and there was a desire to uphold the Protestant Christian faith in Britain among the Anglican clergy.

Modern creation scientists and Flood geologists follow in the footsteps of such notable members of the early Royal Society as William Stukeley, allowing Scripture to inform science about the origin of the fossil record. This evidence further shows the weakness of claims that creation science is an endeavour that only began in the early 20th century.

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A fresh Christian apologetic for a WEIRD age

The Air We Breathe: How we all came to believe in freedom, kindness, progress, and equality

Glen Scrivener

Good Book Company, 2022

Philip B. Bell

Let me get straight to the point. This gripping book is apologetics gold: historically informed, cogently argued, relevant and contemporary, and sparkles with interest from start to finish. It is certainly deserving of the many inside-cover commendations from various Christian movers and shakers. And not just believers, for British historian (and non-Christian) Tom Holland writes: "It is not necessary to be a Christian to appreciate the force of Glen Scrivener's argument in this punchy, engaging, and entertaining book."

Australian author Scrivener is an Anglican minister in southern England, a blogger, speaker, filmmaker, and director of a charity called *Speak Life*.[1] The book is written particularly with non-believers in mind, both those without any religious affiliation and those who have moved on from Christian roots and influences; it is also aimed at Christians, and worth every bit of your time. Numerous historical and contemporary cultural references reveal the author's wide reading, from Thomas Paine to Terry Pratchett, Jean-Jacques Rousseau to Jordan Peterson, Friedrich Nietzsche to Family Guy, Richard Dawkins to Rowan Williams, and many more.

Why *The Air We Breathe*? The explanation is given fully and engagingly in the introduction but is essentially as follows: our beliefs and intuitions are like the oxygen of our vital breath, all-pervasive, obvious, universal, but largely unacknowledged and taken for granted. In 10 chapters and a 'Final Words' section, the author makes a compelling case that needs to be heard and heeded.

So what is Scrivener's main thesis? I can do no better than quote the publisher's own succinct statement:

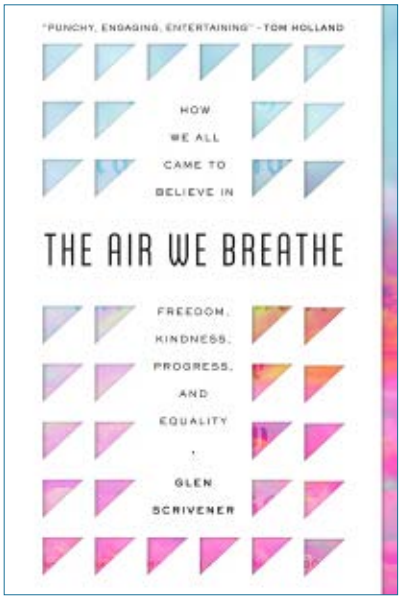
> "Today in the west, many consider the church to be dead or dying. Christianity is seen as outdated, bigoted and responsible for many of society's problems. This leaves many believers embarrassed about their faith and many outsiders wary of religion. But what if the Christian message is not the enemy of our modern Western values, but the very thing that makes sense of them?"[2]

From chapter two onwards, the author builds his case, and this review will follow the chapter headings, highlighting just a few points from each.

Equality

Scrivener begins by quoting Israeli historian and best-selling author Yuval Noah Harari, noting that he buys wholesale into the disturbing evolutionary story of *Homo sapiens* coming to dominate his environment through ruthlessness and greed.[3,4] Yet Harari also has plenty to say about human rights; he admits that God and the human rights story are intertwined.

Unlike ancient creation myths, however, Genesis 1:1 is "a different story, with a different God and a very different outcome for the valuation of humans" (p. 51). Scrivener faithfully outlines the Genesis narrative while



bypassing discussion as to its historicity, or whether the creation days are literal or not. He simply states:

> "… day after day emptiness is filled, potential is formed, chaos is ordered. The heavens, the earth and the waters are commanded, and in obedience to the word of God, they shine, they sprout and they teem" (p. 53).

Throughout the book, the teaching of Genesis is positively upheld, and its relevance clearly brought out. By contrast, Darwinian evolution seems to be cast in a negative light. A hint that Scrivener may hold some sort of 'old-earth' creation view is his description of mankind's creation in Genesis 2 as a 'poetic vision' (p. 55).

Everything else he writes about Genesis 1–3 in the book affirms the distinctness of the biblical record—contrary to those neo-evangelicals who see Genesis as a reworked Ancient Near East myth. The image of God in man is affirmed, "Then Adam and Eve, the first humans, rebel against that voice—the command of God—and chaos ensues" (p. 56). There is no embarrassment about affirming Genesis to non-Christian readers. After all, this account underpins what people

Figure 1. The values people cherish in the largely post-Christian West are nevertheless thoroughly Christian ones (image by Jean-Baptist Burbaud, free use).

in our increasingly 'woke' culture care deeply about (figure 1):

> "… the God story and the equality story stand or fall together. If we feel that life is sacred, that every human possesses an inviolable dignity and equality, … then we are standing on particularly biblical foundations. There is a thread running from Genesis through the New Testament to our 21st-century humanist convictions" (pp. 58–59).

Compassion

Arch-Darwinist Richard Dawkins raised a furore when he alleged it was a moral responsibility to abort babies with Downs Syndrome.[5] In any case, logically, compassion is antithetical to evolution; pity is a poison within his worldview. Likewise, Scrivener shows that Nietzsche consistently applied the enforcement of natural selection (which he believed had led to human existence) to immorality and ethics. It's no wonder Nietzsche was avowedly anti-Christian.

In stark contrast, the author provides a wonderful description of the Cross work of Jesus, who was 'compassion incarnate'. An obvious outcome is that Christians show compassion. "But there's nothing natural about this. Nature is 'red in tooth and claw', as the poet Tennyson put it" (p. 74). It's contrary to alternative worldviews that have dominated history, not least evolutionism. It is why, in some countries, we refer to government officials as 'ministers', the old English word for servant—like Britain's Prime Minister—whereas the ancient Romans called their rulers 'gods'. Compassion and ministering to others are laudable, but not logical, outcomes of human societies where Christianity was never embraced.

Consent

In our salacious age, promiscuity is considered a basic freedom, yet sexual abuse and rape are legislated against, and prostitution is ordinarily frowned upon. The ancients had few of our sexual scruples. In licentious Rome, a visit to one of the numerous brothels cost the equivalent of a loaf of bread. However, "Christianity brought an earthquake in sexual morality" (p. 87). Jesus' teaching often referred his hearers back to Genesis; e.g. that which concerns divorce and remarriage "represents the death of casual sex. It's also the death of easy divorce" (Matthew 19:3–9).

What about those who remain single? "Christ holds chaste singleness in even higher regard. In evolutionary terms, such singleness is a dead end" (p. 92). But the Bible is not prudish, and sex *within* marriage is positively encouraged (1 Cor. 7:4–5). Such teaching was radical in the ancient world. It meant that "The Church became a place of dignity, protection, and provision for women" (p. 95).

And while sexual abuse and paedophilia are rightly condemned today, pre-Christianity things were very different. Sex with boys and girls was actually celebrated in ancient Greece, but Christians rightfully rebranded such pederasty (literally 'love of children') as *paidophthoros* (= destruction of children). In other words, "What the classical world called love, Christians called abuse" (p. 97). The reason most moderns deem those ancient behaviours as crooked is precisely because a straight standard exists; this Christian standard remains in our cultural DNA today.

Enlightenment

Scrivener charts the fall of the Roman Empire and the rise of Christianity, the history of the church advancing and enlightening other cultures through its emissaries (missionaries)—much as Tom Holland details in his tour de force of a book, *Dominion*.[6] The reason we moderns look down upon the misnamed Dark Ages (Medieval period) is that our culture is thoroughly shaped by Christianity. Yet enlightenment ideals already existed in Medieval times: "perhaps 50,000 books [by numerous classical authors] were copied and produced" in the 8th and 9th centuries (p. 118).

What of violence in the name of God? Not all supposedly Christian empire builders renounced the sword, it's true. Some, like Charles the Great (Charlemagne, AD 742–814) were merciless. Yet many in earlier times believed that true enlightenment came through education and persuasion. The Crusades (1096–1229) and the Spanish Inquisition (1478–1834) were dreadful but were grotesque contradictions of biblical Christianity. In fact, says Scrivener, "If we are outraged by the Crusades … that is *Christian* outrage we're experiencing" (p. 115). And dreadful though the Spanish

Inquisition was, the documented deaths were eclipsed by 'secular' atrocities in recent centuries. During just three years of the Red Terror (1918–1921), the Bolsheviks executed 1,400 times as many people as died in several centuries of the Inquisition.[7]

As other historians have demonstrated, misconceptions abound about the 'Dark Ages'. It was a period of terrific technological prowess (magnificent cathedrals, pipe organs, and clocks). There was an increasing recognition of human rights (e.g. the Gregorian Reforms of 1020–1055), universities were established (from the early 13th century onwards), and parliaments too. The Middle Ages were not barren, as many believe. Any idea that the Age of Reason (aka Enlightenment) began with shaking off Christian hegemony is a myth.

Science

Ingrained in our culture is the false notion that Christian religion is at war with science (the 'conflict thesis'). Again, Scrivener does not shrink from affirming God's divine prerogative in creation. Genesis 1:1, he says, shows "God is free. When He chooses to make the world, He shapes it by His own creative Voice so that it's exactly as He wants it" (p. 132). Disappointingly, in rightly affirming God's superintendence of the creation, he allows for deep time:

> "There are regularities in the way the world works, and those regularities are reliable—they hold true both now and back in the Jurassic Age; both here and far away on Jupiter" (p. 133).

This fly in the ointment notwithstanding, all that follows is faithful to Genesis and related as if an entirely factual account.

The author talks of great thinkers, from Augustine to William of Ockham, to Isaac Newton (and many more). He affirms, as have many others, that science was birthed within medieval Christendom.[8] And in the case of Galileo Galilei, it was not that the church invoked Scripture against science, rather "They backed a majority of scientists against a minority" (p. 141).[9]

Image from Wikimedia / Public Domain

Figure 2. Painting by John Trumbull (1756–1843) of the signing of the US Declaration of Independence, which advocated equal rights for all.

Freedom

In 2020, in many countries, statues of many former dignitaries were vandalized and toppled; virtually no memorial was safe if the person was deemed to have had a shady past regarding slavery or racism. The US *Declaration of Independence* (figure 2) famously celebrated the rights of all, "But outside of a biblical foundation, no one in history—including the world's greatest thinkers and moralists—has known about human rights" (pp. 151–152). It's common knowledge that *Christians* strove to abolish the slave trade in the 18th and 19th centuries. Onetime slave Frederick Douglas (1817–1895) later became a great abolitionist and friend of Abraham Lincoln; without doubt, Douglas' Christian faith informed his views. Similarly, Negro Spiritual songs resonate with the Israelites' bondage in Egypt *and* with a redemptive theme that owes much to the Gospel of Christ.

Far from condoning slavery by oppressors, Scripture patterned slaves for redemption. Thus, Jesus declared a Jubilee for all, opening the way for many to be freed from the darkness and bondage of sin (Luke 4:18–19). In 1842, slavery was dubbed 'a crime against humanity'. Nevertheless, abolitionism was a *religious* movement because slavery was especially a crime against the Creator. Scrivener observes, "Now we live on this side of abolition, and our moral imaginations find it nearly impossible to leap backwards" (p. 166). Outcries against racial oppression are because we are breathing Christian air, albeit unacknowledged or disavowed by most.

Progress

Scrivener points out that progress sometimes has a dark side. Darwin proclaimed biological progress, Hegel, historical progress, Freud, psychological progress, and Marx, economic and political progress. The ugly fruit of such philosophies

Image from Wikimedia / Public Domain

Figure 3. A mural by Leonhard Lenz in a Berlin park depicting the death of George Floyd in May 2020; "I can't breathe", he told the policeman kneeling on him.

notwithstanding, Christian ideals run through them like veins in a blue cheese. But without a vertical reference (God unacknowledged), the desire for progress all too easily spawns violence. The 20th century was the most blood-stained in history, the 'murder century'. Think of Stalin's *Holodomor* (Ukrainian: murder by famine) and purge of tens of millions in the 1930s, or of Chairman Mao's 'Great Leap Forwards' (1958–1962), where over 45 million died of overwork, starvation, or murder—not to mention the horrors of death camps like Auschwitz.

Post WWII, a moral standard was needed to establish the 'self-evident' moral truths so bespattered by the Nazis. As with slavery, those atrocities were deemed 'crimes against humanity' but few admitted they were crimes against God. If they were merely "crimes against humanity", we have a dilemma, for humanity was on both sides (evil oppressors and their victims). Scrivener states pithily, "If we're all squabbling apes, then there's no transcendent *justice* in condemning Nazism" (p. 181). So what price progress?

> "The sins we really care about are 'ism's', especially racism and the treatment of minorities. The slurs that stick are the ones that end in 'bigot' and '-phobe' … . This is the kind of moral sentiment we have come to: a mixture of secularised Christianity and post-war antifascism …" (p. 183).

Secularism today, having fled past evils, now pursues values like rights, freedom, and progress, but divorces them from their source. This concurs with Tom Holland's thesis in *Dominion*—without Christianity's humanity-enhancing teaching about the image of God, the ruthless suppression of weaker minorities fits evolutionary logic:

> "To believe that God had become man and suffered the death of a slave was to believe that there might be strength in weakness, and victory in defeat. Darwin's theory, more radically than anything that previously had emerged from Christian civilization, challenged that assumption. Weakness was nothing to be valued. Jesus, by commending the meek and the poor over those better suited to the great struggle for existence, had set *Homo sapiens* upon the downward path towards degeneration.
>
> For eighteen long centuries, the Christian conviction that all human life was sacred had been underpinned by one doctrine more than any other: that man and woman were created in God's image."[10]

The Kingdom without the King

Black American George Floyd died at the hands of the police (May 2020; figure 3), a few months into the COVID-19 pandemic, sparking protests and unrest in the US and around the world. Floyd was quickly portrayed by many as a saint, even a Christ figure. There were communal acts of identification, even repentance; politicians, sports stars, and celebrities everywhere were 'taking the knee'. All "these gestures, slogans and movements came together with a remarkable force … [and] they are Christian in their source", says the author (p. 189). "Whether people realise it or not, these culture wars involved devout believers hurling Bible verses at one another—they've just forgotten the references" (p. 190), to the detriment of society.

It is the same story with other contemporary debates. Transgender advocates want equality, compassion, and consent, but they divorce these from Christianity and recombine them differently. Equality becomes a radical individualism as people emphasize *rights* over institutions and community. Compassion risks becoming what sociologists have termed 'competitive victimhood', and perceived victim status is used to gain advantage. This leads to clashes between different minority groups—e.g. feminists versus trans-rights activists—so whose suffering takes precedence? Divorcing sexual consent from Christian values is a wrecking ball as far as marriage, family, and the wider community are concerned. As Scrivener points

out, "Consent is vital, but it is not a sufficient foundation for sexual ethics" (p. 194). Progressive secularization is not a sustainable strategy!

The WEIRD (Western, Educated, Industrialized, Rich, and Democratic) values upon which Scrivener's book focuses are strongly believed by all, but people in Western society are making a hash of applying them in everyday life. Compared to the ancient world, equality, compassion, consent, enlightenment, science, freedom, and progress were given a makeover by Christianity, and these are dear to the hearts of modern people. As Scrivener says, "These are our creedal convictions, and, by and large, we are a society of believers" (p. 197). But even as people are straining to discard Christianity, they continue with their moralizing:

> "If anyone blasphemes our WEIRD values … we 'cancel' them—that is, we ostracise them socially and professionally. This is really a modern form of 'excommunication' for modern kinds of 'heretics'" (p. 198).

And anyone can find themselves a target, especially, as the author wryly observes, with the turbo-charging of outrage made possible by social media.

In today's 'cancel culture', there is plenty of guilt, but without grace, forgiveness is nowhere in sight! Scrivener is right on the money in noting that the denial of King Jesus, while trying to retain Christian ideals, brings judgment, not liberation:

> "In order to purse the kingdom without the King, we have had to dethrone the *person* of Christ and install abstract values instead. … [But] Values can only judge you" (p. 200).

People need the Gospel of hope, so the author invites readers to consider how history will judge *them*—more especially how will *God* judge them? Wonderfully, Christ came not to police people's morals so much as to heal them, to cleanse and forgive needy, despondent human beings.

Choose your miracle

It is good to see that the author returns yet again to Genesis, this time to Genesis 3:15 in closing out the book, the prophesied redemption through the woman's seed (a Saviour). He shows the unfolding of the promise in the pages of the Old Testament, not least the prophesies of Isaiah and Daniel. "No wonder messianic expectation was at fever pitch in the 1st century" (p. 211), because Israel was under the rule of Rome. Christ came, predicting the triumph of His kingdom, though via His death and Resurrection. Thus, the Jesus revolution fulfilled the Genesis promise.

But maybe the whole story was fabricated? Scrivener skilfully defends the Gospels and their accounts of Christ, and he does so in a highly original and compelling manner, demonstrating their sheer genius. The strong evangelistic approach is fresh, not hackneyed. Jesus, the History Maker, is the One behind the values so cherished by the West—He embodies them. In fact, Christ loved this world to death, pioneering life for all violators of those values through His Resurrection.

This is not a book which fizzles out towards the end. In its closing pages, Scrivener appeals in turn to the three categories of readers mentioned in the second paragraph of this review. It is refreshingly honest and very well executed. To Christians, he writes, "In all this, great wisdom is needed to discern the Christian-*ish* values of a WEIRD culture from true Christianity" (p. 230). Absolutely, and this book deserves to be very widely read.

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Evolution has no pillars to rest on

The Three Pillars of Evolution Demolished: Why Darwin was wrong
Jerry Bergman
Westbow Press, IN, 2022

John Woodmorappe

Jerry Bergman is a well-known creationist author who has extensively published over many decades and who has taught at several universities. He has taught biology, biochemistry, anatomy and physiology, genetics, and other courses for over 40 years. He has over 1,700 publications in both scholarly and popular science journals and monographs.

The three pillars of evolution identified by Bergman are abiogenesis (aka chemical evolution), natural and sexual selection, and mutations. The author of this book finds all three of these pillars defective as evidence for evolution.

Naturalistic origin of life assumed, not demonstrated

Bergman is especially critical of Miller–Urey 'chemical soup' explanations for the putative abiogenesis of life, not so much because they are grossly inadequate, but because they are not even seriously examined. The media hype came thick and fast. The author comments:

> "In spite of these many now-recognized lethal problems, Miller's 'breakthrough' resulted in front-page stories across the world that often made the sensational claim that they had 'accomplished the first step toward creating life in a test tube'" (p. 52).

At the academic level, things were not much better. Bergman quips:

> "A review of recent college biology textbooks found that most all discussed the Miller-Urey experiments, some extensively, but it was a rare text that mentioned any of the problems" (p. 73).

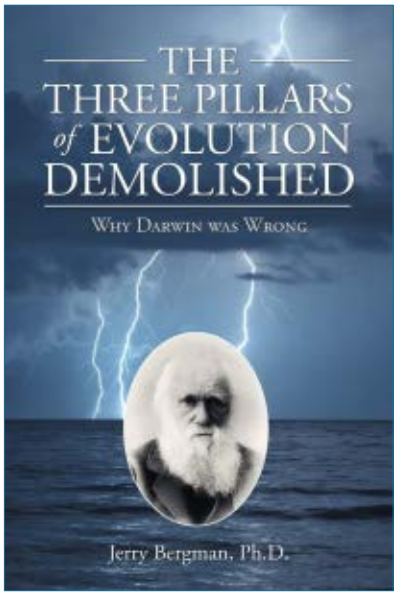
The fatal problems of 'chemical soup' experiments

Even without considering information content, the 'chemical soup' experiments run into immediate problems. Bergman remarks:

> "An often-ignored problem is that the Miller-Urey experiment also produced small amounts of many compounds very toxic to life, including hydrogen cyanide, formaldehyde, and formic acid. Fully 98 percent of the compounds produced were gooey tar and certain carboxylic acids which interfere with possible life formation" (p. 51).

There is the problem of amino acid concentration in the primitive ocean. At realistic concentrations, only short proteins could possibly be formed, and even this is dubious. Invoking small pools of water, or deep-sea vents, does not overcome this difficulty. Bergman comments:

> "Unfortunately, for both warm-pond and hydrothermal-vent theorists, this extreme heat has proven to be a major impediment for their theories. High temperatures accelerate the breakdown of amino acids …" (p. 65).
>
> According to Bergman:
> "Producing even simple amino acids and functional proteins requires highly laboratory-controlled experiments. Even under these ideal conditions, the very conditions hypothesized to create amino acids also rapidly destroy proteins" (p. 60).



But what if biologically meaningful proteins could somehow have been made on a pre-life earth? Amino acids can be assembled into proteins in a staggering number of different ways. For example, given 20 amino acids and a polypeptide of 500 of them, there are at least 20^{500} ($\sim 3\times10^{650}$) ways of doing this. This far exceeds all the atoms in the known universe. There is no information specificity in any of this.

Apart from all this, there is the chirality of amino acids. That is, all but the simplest, glycine, exists as either a 'left-handed' or 'right-handed' form. These form randomly in 'chemical soups', but are decidedly non-random in living things.

Faced with these difficulties, some evolutionists now propose that life began with RNA. This encounters at least as many fatal difficulties as the DNA-first approach. Bergman reminds us that "A main one is that RNA is not a stable molecule, thus it requires RNA-binding proteins or it readily falls apart during localized transport. It is also readily hydrolyzed in liquid solutions …" (p. 68). Another one is that the chirality problem is even more acute for the ribose sugar in the 'backbone' of RNA.

We have exobiogenesis—the belief that life arose on another planet. Note that this does not solve the problem

of the origin of life—it merely relocates it to some hypothetical planet. So we are right back to square one, to which are added additional problems. For instance, there are the colossal distances between the stars, through which living things would have to be transported, especially in an unhospitable environment. Exobiogenesis is pure speculation. Pointedly, there is no evidence that life exists anywhere in the universe, except on Earth, in the first place.

Finally, 'chemical soup' experiments very much confuse the issue. Forming the 'building blocks' of life, by abiogenesis, is the trivial part. The hard part is accounting for the information content necessary for even the most rudimentary form of life. Evolutionistic origin-of-life hypotheses do not even begin to do this! Bergman offers this analogy:

> "Producing life's building blocks is relatively easy in the lab—the modified Miller-Urey experiments eventually produced 25 different kinds. Likewise, natural objects in forms resembling the English alphabet (circles, straight lines, etc.) abound in nature, but this fact does not help us to understand the *origin of information*, such as found in words or combinations of words, such as in Shakespeare's plays [emphasis in original]" (p. 68).

Most 'neutral mutations' are not neutral after all

The next pillar of evolution, examined by Bergman, is that of mutations. The term 'neutral mutation' refers to a mutation that neither enhances nor reduces the fitness of the organism bearing it. Evolutionary orthodoxy long held that most mutations are neutral. Bergman challenges this and shows that most 'neutral' mutations are mildly deleterious. This creates a new problem for evolution. 'Neutral' mutations are not innocent, as previously believed. They do not kill the bearer outright, but, because their harm is subtle, they accumulate with other 'neutral' mutations in the genome. Bergman warns, "Even mutations that have 'little effect' on health can accumulate both in somatic and germ cells, eventually causing major damage" (p. 120). The harm can be cumulative, "A few examples given in this chapter illustrate why the accumulation of near-neutral mutations contributes to the 'mutational meltdown' problem, eventually causing extinction" (p. 123).

Synonymous codons are not neutral

Bergman extends his analysis of so-called neutral mutations. For the longest time, biology textbooks have taught us that usually more than one DNA codon can code for a given amino acid. This premise tacitly assumes that the redundant codons are fully interchangeable with each other in terms of their phenotypic effects. Bergman challenges this, but first he introduces the subject:

> "One example is the putative neutral mutation that changes a DNA codon, such as UCU (which codes for serine), into a new codon, such as UCC, UCA and UCG, each of which are also translated into serine … . As many as six different codons can produce the same amino acid, and most amino acids can be coded by at least three synonymous codons" (pp. 130–131).

Figure 1. Sexual selection can be invoked to explain almost anything, such as gender differences in the plumage of birds.

It turns out that 'synonymous' codons are not identical in their effects relative to each other. The choice of codon determines the level of transfer RNA (tRNA) that is used to construct the protein, and thus its construction rate. The author concludes:

> "As a result, even though the protein amino acid set does not change when a different synonymous codon is used, cellular efficiency does. The problem, called codon usage bias, in which a certain codon from the functional set is favored in highly expressed genes, is clear evidence for non-neutrality of synonymous substitutions. This bias is found in all known eukaryotic and prokaryotic genomes" (p. 130).

The non-neutral synonymous codons and their teleological implications

Some opponents of Intelligent Design have argued that synonymous codons show that no designer was involved in the origins of protein coding. After all, we are told, no intelligent designer would come up with such a 'redundant' and 'sloppy' system. As with all dysteleological arguments, this one equates the critic's particular *opinion* of a living system with the assumed *flawed nature* of that system. It also presumes what an intelligent designer would or would not do. Finally, it is a changing of the argument, as it does not even begin to explain how a non-intelligent process could spontaneously give rise to a protein-coding system in the first place.

Although Bergman does not consider his findings from this angle, the implications of non-neutral synonymous codons are not hard to deduce. On the critic's own terms, the protein-coding system is not nearly as 'redundant' and 'sloppy' as the critic has made it out to be! This is one more nail in the coffin of this dysteleological argument.

Natural selection—an amorphous and misleading term

The third pillar of evolution is identified as natural selection. Bergman has a way with analogies. He compares the claims of natural selection with the statement, "The man is rich because he has money." Others have characterized the natural selection explanation as a 'survival of the survivors' statement.

One must make a clear distinction between the arrival of the fittest and the survival of the fittest. The two, though often conflated, are most certainly not the same. The confusion goes back to the very beginning, as pointed out by Bergman:

> "Darwin … portrayed natural selection as equivalent to artificial breeding, thereby making it more difficult to refute natural selection by arguing that it was a real physical force. Claiming that nature does the selecting avoids the requirement of discussing the actual factors involved in the causation events attributed to natural selection. Such obfuscation may have been excusable in Charles Darwin's day, but is inexcusable in ours" (p. 165).

Once again, the real issue—arrival of the fittest—is avoided.

Natural selection is a catchall explanation

> Jerry Bergman gets right to the point: "As we will document, natural selection is most often not an explanation for new biological traits, yet it is used to explain almost everything in the living world. How did mammals, birds and reptiles evolve? Natural Selection. How did birds learn to fly? Natural Selection. Why do tetrapod animals run on all four legs? Natural Selection. Why did whales evolve? Natural Selection. Natural selection is used to explain almost everything in life, but actually explains nothing" (p. 152).

Natural selection, as used by evolutionists, gives rise to adaptationist just-so stories that are freely invoked to explain even diametrically opposite traits. Thus, when a bird has inconspicuous plumage, it is, we are told, because camouflage has afforded it enhanced ability to survive compared to that of its ancestors. But when a bird has conspicuous plumage, it is because this has increased its mating ability (figure 1).

The concept of natural selection presupposes that organisms are survival machines, and is contradicted by the existence of anatomical features that are disadvantageous to the bearer. As an example, Bergman focuses on elephant tusks. He comments:

> "Ecologists also conclude that the enormous tusks of the elephant burden it with many more disadvantages than advantages. Elephants without tusks survive quite well—and although almost all African male and most female elephants have them, many Asian males and nearly all Asian females do not" (p. 280).

Natural selection does not even have theoretical explanatory power in many cases. Bergman comments:

> "Human life consists of many activities that are mentally pleasurable, none of which natural selection convincingly explains. Walking in forests, listening to music, creating poems, doing scientific research, aesthetic enjoyment of nature, and myriads of other activities are often not related to survival, or adaptation in a Darwinian sense. Some writers have struggled in vain to explain the existence by natural selection of our human ability to create music and art, all of which involve extremely complex body and brain systems" (p. 213).

The *ad hoc* nature of natural selection extends to the concept of 'ecological niche'. For example, when the fish first evolved into land-dwelling tetrapods, it was, we are told, because the land-dwelling niche was vacant. But when land-dwelling mammals evolved into aquatic mammals, it was now because the aquatic niche was vacant.

Sexual selection

Sexual selection is a form of natural selection. It shares the problem of *ad hoc,* after-the-fact sweeping explanations for biological traits, as does natural selection. Bergman remarks, "In the popular and scientific literature alike, almost every physical and psychological trait imaginable is attributed to sexual selection" (p. 217). For example, see figure 1.

Even the theoretical basis for sexual selection can be questioned. It is doubtful if creatures actually mate preferentially according to fixed traits that are found in one or both partners. The same holds for behaviours. For example, consider fighting for the 'right to mate'. It turns out that females mate with defeated males as well as with victorious males. In addition, at least with reference to primates, Bergman writes:

> "One example is that recent primate studies ranging from rhesus monkeys to chimpanzees have found that females commonly seek to mate with low-status, low-hierarchy males, which is the opposite of that predicted by Darwinism and assumed to be true for decades" (p. 223).

Conclusions

Bergman has examined claims of abiogenesis, the nature of mutations, and the explanatory power of natural selection. As in the title of this book, he has thoroughly demolished them. The monopoly of the theory of evolution, in academia, is all the more irresponsible. In fact, it is puzzling.

De-misting Genesis 1

The Misted World of Genesis 1
Michael Drake
Wycliffe Scholastic, Auckland, 2020

Shaun Doyle

The Misted World of Genesis 1 is a forceful and deep defence and exposition of the traditional 'historical week' reading of Genesis 1 (figure 1). Author Michael Drake is the Founding Principal (Retired) of Carey College, a Year 1–13 Christian School in Auckland. He focuses on more recent interpretive strategies to harmonize Genesis 1 and long-age geology/evolution that draw on recent theories of linguistics, biblical scholarship, and Ancient Near Eastern (ANE) studies. The book is divided into two main sections: part 1 is a critique of contemporary long-age-friendly approaches to Genesis 1, and part 2 is a positive exposition of Genesis 1.

The book has strengths and weaknesses. In general, some of Drake's hermeneutical tenets hamper his critique of current long-age approaches to Genesis 1, but his attention to textual detail provides some important insights in his critique. And that attention to textual detail really shines through in the second part of the book, where he exposits Genesis 1.

Weaknesses

Primacy of the 'plain sense'?

Modern attempts to marry deep time and Genesis 1 generally attribute a meaning to Genesis that departs quite severely from a plainly literal reading. Drake believes these attempts violate an important hermeneutical tenet. "The remedy is simple: Take the text to mean what it says unless the text itself demands otherwise" (p. 32). But how can 'the text itself' demand otherwise? He says:

> "Only a fool would deny that the Bible contains symbols, metaphors and a variety of language techniques that enrich its message and it [*sic*] usefulness. But the Bible itself makes clear where those techniques are being used" (p. 32).

However, this doesn't work. Drake regards a statement such as "all the trees of the field shall clap their hands" (Isaiah 55:12) as "plainly a metaphor" (p. 143). However, nothing *in the Bible* makes that clear. Rather, something *outside* the text makes that clear: our observational understanding of nature. As such, we cannot avoid the use of information outside the Bible to properly understand its meaning.

Indeed, even our first-glance notion of a biblical passage's 'plain sense' is filtered through extrabiblical information. For instance, we discern the meaning of biblical words from comparative literature study that goes well beyond the Bible. The same is true for idiomatic phrases and even entire genres. These tools can of course be abused. And there is a good case to be made that Genesis 1 has been fertile ground for abusing these hermeneutical principles to make an unwilling text compatible with deep time.[1] But none of this means that the Bible is its own exhaustive hermeneutical manual. That the Bible is the *final* guide for its own interpretation doesn't mean it's the *only* guide we need.

Can we use ANE to help us understand Scripture?

It has become a trope that appeals to the 'Ancient Near Eastern context' automatically signal one's rejection of the plain sense of Genesis 1. In response, Drake rejects the use of ANE literature to enlighten our understanding of Scripture:

> "All that is sufficient and necessary to understand the Bible rightly is given in the Bible. Cultural context, for example, can be significant in understanding and applying the message in any particular passage, but such information about that cultural context as is needed is given in the Bible" (p. 10).

He pushes this to the point of completely isolating Genesis and Israelite culture from the rest of the ANE world:

> "Genesis self-consciously differentiates itself, its message, and the Hebrews to whom it is addressed, from the surrounding cultures of its day. Genesis presents its own cultural context within which ancient and contemporary readers can find the same meaning" (p. 51).

But this misses the point: Genesis self-consciously differentiates itself *from the cultures of its day*. The *ideological content* of Genesis is in many ways unique, but it conveys that ideology by addressing many of the same concerns the surrounding cultures had and using many tropes and modes of expression they would be familiar with. Our knowledge of these commonalities is deepened by

broader access to other ANE literature. Plus, knowledge of those commonalities helps us read Genesis better. But this implies that the ANE literature outside the Bible can materially change our understanding of Genesis *for the better*.

A modern parallel would be Lee Strobel's *The Case for Christ* and Richard Dawkins' *The God Delusion*. They support different worldviews, but their shared cultural context means they share many concerns, tropes, and modes of expression. Clearly, knowledge of these shared elements could enrich our understanding of these texts and help us see things in them that we wouldn't otherwise see. Conversely, ignorance about these things could diminish, or even undermine, our understanding of these texts.

Like other extrabiblical information, the ANE literature can be abused.[2] And below I will discuss how Drake *accurately* details some of how long-agers have abused it in relation to Genesis 1. However, abuse doesn't preclude proper use.

Inerrancy and biblical meaning

The Bible is without error. As *God's* word, it is perfectly trustworthy and true. But what counts as an error? This is where agreement ends. Debates about the relation between hermeneutics and inerrancy quickly becomes a tangle of hard-to-distinguish issues.

There are of course limits. For instance, declaring that there are "variant expressions of God"[3] in Scripture clearly doesn't comport with inerrancy (or, frankly, Christianity!). More proximately, the idea that the Bible unambiguously postulates a literal 'pre-scientific' (i.e. false) dynamical theory of cosmology doesn't comport with any intuitive notion of 'inerrancy'.[4]

But what place does Genesis 1 have in these debates on hermeneutics and inerrancy? Drake puts Genesis 1 at the centre (chapter 7). However, this raises a difficulty—some of those Drake argues against on the relation between hermeneutics and inerrancy actually agree with him on the meaning and truth value of Genesis 1. James Patrick Holding, co-author of the book *Defining Inerrancy*,[5] which Drake criticizes along the same lines he criticized Collins and Walton (pp. 130–131), is a young-age creationist and accepts the historical week interpretation of Genesis 1. He has even contributed significantly to the creationist literature on matters of hermeneutics and exegesis.[4] Other biblical creationists take similar 'contextualizing' approaches to biblical interpretation as the likes of Collins and Walton.[6]

On the other side, not all those who support the sort of relation between inerrancy and hermeneutics to which Drake subscribes agree with a 'historical week' reading of Genesis 1. Norman Geisler, author of *Defending Inerrancy*,[7] and a major champion of many of Drake's hermeneutical methods, believed in day-age theory and was an old earth creationist.

Inerrancy *is* relevant to *some* aspects of Genesis 1 and the origins debate. Indeed, one of the authors Drake critiques on his views on the relation between inerrancy and hermeneutics has argued for this in Genesis 1.[4] However, many of the disputes over inerrancy and hermeneutics Drake addresses exist *among biblical creationists*, and so don't necessarily contribute to resolving the debates about Genesis 1. We need to be careful to delineate which issues are relevant and how.

Figure 1. How hard is Genesis 1 to understand?

Misquotes and misinterpretations

Drake also misquotes and misinterprets his opponents in several places in significant ways. For instance, Drake quotes Walton as saying: "willing to bind reason if our faith calls for belief where reason fails" (p. 19). And then he comments:

> "Whatever the intent, the effect of such a statement is to assert that the Bible can only control reason where reason is found faulty. It makes reason, not the Bible, the ultimate authority on truth" (p. 19).

However, the intent of Walton's statement is the exact opposite of what Drake suggests. Consider the context of Walton's quote:

> "We must not let our interpretations stand in the place of Scripture's authority and thus risk misrepresenting God's revelation. We are willing to bind reason if our faith calls for belief where reason fails. But we are also people who in faith seek learning. What we learn may cause us to reconsider interpretations of Scripture, but need never cause us to question the intrinsic authority or nature of Scripture."[8]

The surrounding context arguably telegraphs a practical case of 'reason trumping faith' in the rest of Walton's book. However, in the quote itself 'our faith' is a stand-in for 'Scripture'. As such, Walton is admitting that *Scripture* 'binds reason' such that we must believe Scripture even when reason seems to say Scripture is wrong. In other words, *the authority of Scripture trumps the authority of reason*. This is the point Drake wants us to agree with: "The test of reason is the degree to which it agrees with Scripture" (p. 20). However, Walton agrees with it *in the very quote* Drake uses to display an opposing view.

Second, Drake misquotes Walton:

> "Walton is quite clear on that: 'to assign something its functional role ... is to bring it into existence.' … Yet in the very next sentence he asserts 'something must have

physical properties before it *exists* [emphasis added]'" (p. 68).

The second quote does not exist in Walton's book. The whole context runs like this:

> "Consequently, the actual creative act is to assign something its functioning role in the ordered system. That is what brings it into existence. Of course something must have physical properties before it *can be given its function*, but the critical question is, what stage is defined as 'creation' [emphasis added]?"[9]

However, Drake builds his entire argument against Walton on the supposed use of the word 'exists' in the second quote:

> "This is linguistic conjuring, using the word 'existence' with a commonly understood meaning in a way he defines to the exclusion of common understanding, and doing that with what amounts to little more than a passing comment in the fine print. Walton consciously but with restrained admission uses 'existence' to describe physical existence that does not exist" (p. 68).

Drake is the one guilty of 'linguistic conjuring' in this instance. The word 'exist' doesn't exist in the quote from Walton.

Strengths

Use and abuse of ANE literature

While I think there is a place for using the ANE literature to shape our understanding of the Bible's meaning, that doesn't mean that all attempts to do so are good or well justified. Drake incisively points out that the 'cultural context' that supposedly informs our understanding of Genesis is constructed from a pastiche of mostly fragmentary texts, with divergent genres and purposes, drawn from several different cultures spanning *centuries* (pp. 50–51). Exactly how confident can we be that we are accessing genuine commonalities even in 'background' matters such as concerns, tropes, and modes of expression?

Two highlights are worth mentioning. First, Drake magnificently displays how the ideological differences between the monotheism of the OT and polytheistic pantheism of the surrounding ANE cultures creates drastic differences between Genesis 1 and ANE cosmological myths in terms of purpose and focus. For the ANE myths, Drake explains:

> "Reading myths served the same purpose as having sex with a temple prostitute: by words or actions the deeds of the gods were rehearsed, bringing participants into concert with the gods and nature" (p. 92).

Indeed, these were means to *manipulate* the gods, which are equated with the various forces of nature, to one's benefit. Genesis 1, however, heads a narrative of God's mighty acts *in history* and reveals his *moral* will for us to follow. God won't be manipulated by mimetic activity—merely *reading* the Bible isn't enough. One must *understand* the information presented, *remember* God's mighty acts, and *respond* to it all appropriately. As such, if there are any commonalities between the ANE myths and Genesis 1, they will serve in conveying a *drastically* different message in Genesis 1. And this may alter the tropes themselves, attenuating the commonality even at the most superficial levels.

Second, his takedown of the comparative methods used to establish the supposedly ubiquitous 'flat earth, solid sky' cosmology of the ANE world (figure 2) is well worth reading (pp. 99–105).

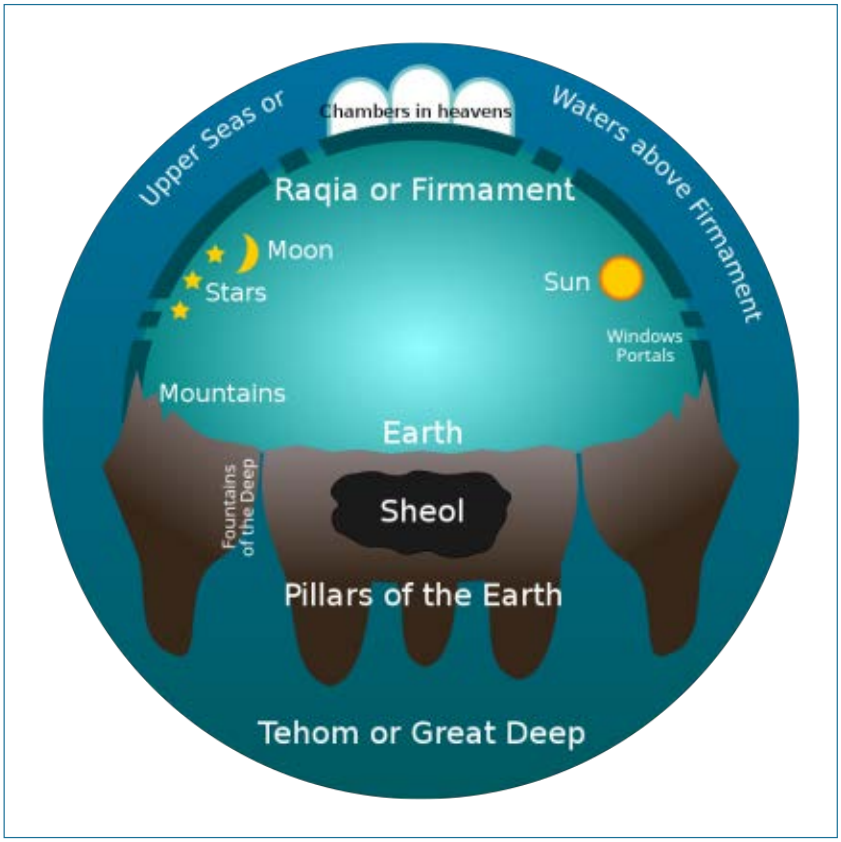


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Figure 2. The so-called 'ancient cosmology' of the Bible and Ancient Near East, which is pieced together more by supposition and data selection than solid inference.[11]

Exegetical critiques of Walton and Collins

The occasion that prompted Drake to study Genesis 1 and ultimately write *The Misted World of Genesis 1* was a series of lectures John Walton and C. John Collins gave in Auckland in 2013. So, it's no surprise that most of his critique focuses on their proposals. And his familiarity with their work shows through. He makes some incisive critiques of both their specific proposals.

Concerning Walton, he understands that perhaps the most important *exegetical* argument Walton has for his proposal regards the meaning of *bara* and *asah*. On both, he interacts with the lexical data Walton puts forward (especially on *bara*) and points out that it demonstrates precisely the opposite of what Walton says it demonstrates (pp. 70–71).

Concerning Collins, Drake does a good job deconstructing Collins' specific reasons for thinking "that the reader is invited to sit lightly on sequence and time lengths."[10] Concerning the highly patterned nature of Genesis 1, Drake incisively points out: "Genesis 1 is patterned, not because it follows a pattern but because it establishes one" (p. 138). He rightly compares the supposedly 'exalted' language of Genesis 1 to Psalm 104, which is richly poetic, and finds Genesis 1 mundane in comparison (pp. 139–140).

A faithful and fruitful reading of Genesis 1

The true value of the book is found in its second section. It's a deep dive into Genesis 1. Drake here is careful in his handling of the text, makes well-reasoned judgments on the meaning of some of the more controversial sections, and explores the theological implications of many of the features of Genesis 1 in considerable depth. Even where one may disagree with a specific judgment he makes, one can see why he has made it.

For instance, his discussion of the grammar and purpose of Genesis 1:1 (pp. 180–186) is interesting, aware of the main debates, and makes a careful judgment that it details the first act of Creation Week. His discussion of the creation of humanity covers a full two chapters (chapters 10 and 11) and provides tons of material for profitable theological reflection. In his chapter on Day 7 (chapter 12) Drake makes a brilliant observation against the notion that Genesis 2:1–3 speaks of an 'eternal sabbath day' because it lacks the "and there was evening, and there was morning" refrain of the previous six days. It is worth quoting at length:

> "Yet the lack of refrain has both obvious and clear significance. The first part of the refrain 'there was evening, and there was morning' has been used to indicate transition from one day of creation to the next. That is, it has not been primarily used to identify the completeness of each day—*that* has been signalled by numbering each day, just as this seventh day is numbered ('on the seventh day, God …'). So when at the end of the seventh day there is no transition to the next day of creation, guess what? There is no further day of creation to transition to. Seven days of extraordinary creation and rest are clearly numbered as seven days of ordinary length. The week of creation has been contained, in a literary sense, by an introduction, by six bridging/transitional refrains, and by a clearly marked change in language to bring it to an end. Rather than indicating day seven is not of ordinary length, the lack of refrain signals that the first week in history of seven days of ordinary length has been completed" (p. 287).

Genesis 1 de-misted?

The Misted World of Genesis 1 is a book of halves. The first half contains most of the weaknesses, and the second half contains most of the strengths. When Drake is dealing with the Genesis 1 text, he is almost always very careful and cogent. Sadly, this is not as much the case when dealing with those he critiques, which makes part 1 much weaker than part 2. Nonetheless, there is a lot of useful material in Drake's analysis, and it repays close examination even where one disagrees. Drake has done his homework, and even if I don't agree with all his solutions, his commitment to a clear and uncompromising exposition of Genesis 1 as the foundation of our faith is clear. May we all read Genesis 1 with the clarity Drake invites us into.

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Socialist science in the 20th century

Stalin and the Scientists: A history of triumph and tragedy 1905–1953

Simon Ings

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Marc Ambler

CMI has often dispelled the public perception of white-coated scientists dispassionately and objectively following the science where it leads. Presuppositional bias toward philosophical naturalism drives the interpretation of data that seems to support deep-time cosmology and evolution as an explanation of origins. The same can be said of a commitment to the divine inspiration of the Bible, which biases creation scientists toward a supernatural, six-day creation interpretation of the origins of the universe.

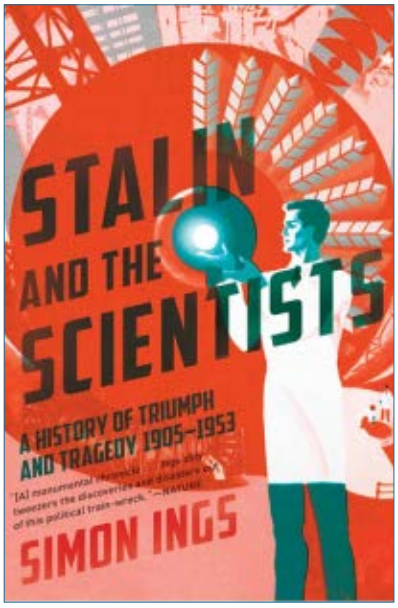
It is often pointed out, when it comes to origins, outside of the direct reach of the scientific method of experiment and observation, that those involved in historical science are compelled to follow interpretations of the evidence that fit their preferred authority and narrative of existence. What is sometimes missed, though, is that scientists in other disciplines, including the so-called 'hard sciences', are made of the same stuff as their colleagues and mankind in general. As fallen children of Adam, we are all by nature prone to selective bias toward our preferred outcomes and narratives.

We seem to be wired for bias. The question is whether our bias is towards the truth or deception.

Stalin and the Scientists is a record of how sometimes brilliant, sometimes hack scientists were led to scientific conclusions increasingly driven by ideology, fear, political affiliation, peer pressure, self-preservation, prestige, and the fringe benefits of acquiescence to the *zeitgeist* of Stalin's Russia under the Communist Soviet Union.

Heritage

Russia has a history of some brilliant scientists. Men like Dmitry Mendeleev (p. 57), the chemist and inventor who formulated the Periodic Law by which to describe the elements, and substantially developed the Periodic Table of Elements. That heritage was increasingly squandered in 20th-century Soviet Russia as ideological and political considerations took precedence over the search for truth as the driving force of 'science'. After the Russian Revolution of 1917, increasingly centralized control ensured that Russian science could at once be the most funded by GDP, have the most scientists by population, and at the same time become the 'laughing stock of the intellectual world' (p. xv). These non-scientific agendas sometimes were set aside when pragmatic circumstances dictated, such as in the race against the West for the USSR to develop nuclear weapons. Ideological conformity was not required of those working on the program, Stalin tellingly saying to his head of the NKVD Lavrentiy Beria, "Leave them in peace. We can always shoot them later" (p. 392).



Ideology trumps pure science

Just as a biblical worldview underpinned the development of Western science, the antithetical worldview of materialism led to its demise in Soviet Russia. The founders of Communism—Marx and Engels—left an indelible ideological stain on Soviet science that continues today in much of Western science as that worldview becomes dominant. The dialectical materialism of Friedrich Engels required and, by its own philosophy, demanded that all the scientific and societal disciplines conform to a unified 'science of everything' (p. xvi). Of course, they believed this would bring about a "huge benefit for mankind".

"The fool says in his heart, 'There is no God'." And no matter how brilliant and qualified the atheist, the fruit will ultimately be a poisoned apple. By definition, an atheist (including the writer of the book, based on many of his observations) has to 'explain' everything by natural, material causes, even "things like love, and grief, and memory, and the colour green" (p. 28). This, of course, gives rise to the 'scientific government'

of Karl Marx, who believed that "it might be possible to extend the natural sciences into all spheres of life." The 'scientific government' (p. 29) that would inevitably lead to a world-dominating Soviet utopia. This is *scientism*, religion masquerading as science; a religion set free from any of the metaphysical constraints and values of traditional theism. Soviet politicians and, increasingly, their scientists believed that the Communist revolution would create a "city of science, a series of temples where each scholar is a priest who is free to serve his god" (p. 426) (i.e. the god of philosophical materialism).

Ironically, having exhaustively documented the abject failure of Russian science to achieve this goal, the author ascribes that failure not solely to the ideology itself, but partly to historical timing and the failings of individual men and women, and mostly to "the failure of the sciences themselves to cohere into a single, coherent discipline that politics might wield" (p. 426). His is still the religious scientism of the progressive mind, the faith that a utopia is still possible with enough concentration of resources, thought, and effort.

Science in Russia became a tool to serve the revolution and the government spawned by that revolution. "Philosophy and all other branches of theory must be refashioned to be of immediate service to the revolution" (p. 191).

Like any religion, 'scientism' requires an enemy, which was 'Western science' (p. 381), an omniscient authority figure (in the absence of God), and a loyal priesthood. 'Self-criticism' became a regular ritual of the doubting scientific congregants (p. 380).

Scientific infallibility

Lenin saw himself as a 'mental athlete'; his brain was preserved and studied after his death, which of course confirmed his own estimation of himself (p. 137). But it was Stalin who took this mantle of infallibility to absurd depths. He regarded himself as the 'Great Scientist' and was instrumental in reviewing and editing numerous scientific speeches and articles (p. 379), as well as in the destruction of dissenting scientists or the elevation of those that conformed to his ideology of the 'scientific priesthood' (p. 245). He established the Stalin Prize for scientific research and was elected by the Academy of Sciences as an honorary member. They flattered Stalin by calling him 'The Coryphaeus of Science' (p. 259; *Coryphaeus* was the chorus leader in Classical Greek drama who spoke on behalf of everyone).

The author shows how this cultish elevation of an individual who "dreamt of one day plucking fruit from Arctic lemon trees" (p. 351) actually oversaw the destruction of Russian science.

As an anti-god ideology, Marxism demanded material explanations, rejected the distinction between mind and matter (p. 394), and denied individualism in favour of the collective, leading to cruelty and death on a massive scale. It was ethically unconstrained, and as there was no ownership, resources had no value, leading to devastating environmental degradation where "energy and materials were used without regard for waste or loss" (p. 431).

In light of Stalin's atheism, his death, as described by his daughter Svetlana, is instructive:

> "At what seemed like the very last moment he suddenly opened his eyes and cast a glance over everyone in the room. It was a terrible glance, insane, or perhaps angry and full of fear and death" (p. 398).

Lamarck vs Mendel

The book traces numerous scientists in diverse disciplines from rocketry to cybernetics to physics. But there is a recurring theme throughout the book, that of the biological sciences. As a country with a history of regular and devastating famines, it is understandable that biology and the overlapping fields of agronomy, farming, animal husbandry, and breeding would be prioritized in Russian science. But even here, ideology was sacrosanct and caused scientists to follow rabbit trails, often to the detriment of feeding the people, and consuming vast resources.

In the biological sciences there were two main streams of thought in the early 20th century. The first was that of Jean-Baptiste Lamarck, the 19th-century scientist who believed that characteristics developed during the life of a living organism, such as increased strength, size, or speed, could be passed on by inheritance to the next generation. The theory is summarized by the phrase "inheritance of acquired characteristics". Charles Darwin himself toyed with Lamarckian ideas to explain the evolution of life.

The model of inheritance increasingly confirmed and accepted in the Western world at the time, though, was that of the 19th-century Augustinian friar Gregor Mendel. Mendel, through his famous experiments with the growing of peas, developed a theory of genetic 'units of heredity', where characteristics such as size, colour, and taste varied from one generation to the next within fixed, mathematical bounds of the genes of the previous generation. This implied that a fixed set of cards was dealt to mankind, with place for shuffling of those cards, but very little room for continuous development and improvement. In short, the implication of genetic inheritance confirmed Mendel's belief and stoked Marxist fears of a creator.

It is obvious, then, why Lamarck's ideas would have appealed to an ideology of continuous dialectical improvement, beginning with the imperfect and leading to ever-greater progression without the need for God. If this process could be harnessed, it was seen by Marxist ideologues and Bolshevik scientists as a means to the cure of diseases within one generation (p. 118), the improvement of "people's physical and mental well-being within a single generation" (p. 117), and the inheritance of 'acquired behaviours' (p. 126) set by Marxist technocrats by future generations. This would establish the Bolsheviks as 'captains of the future' (p. 121). In the words of one of the influential Russian scientists of the time, they would be in charge of a world where "all living nature will live, thrive, and die at none other than the will of man and according to his designs" (p. 194). It would enable Russian scientists to give Stalin his Arctic lemon trees.

And so Mendelian genetics was vehemently rejected for these ideological reasons, as well as that it was believed to be of 'foreign provenance' (p. 193) as opposed to Soviet Russian. Of course, Western scientists obligated to materialism were also presented with the teleological implications of fairly rigid genetic boundaries. In the 1930s, the Darwinian Synthesis was developed that sought to discard these genetic restraints by positing natural selection of random genetic mutations as the drivers of evolution. This is a theory that almost 100 years later has a paucity of supporting evidence but is clung to desperately by evolutionary scientists in the absence of any other suitable mechanism to explain life without God.

But even this Neo-Darwinian theory was unsatisfactory to the Marxist as it implied slow, random, undirected processes, which are never acceptable to the impatient 'Progressive' mind.

"Stalin was himself a totally dedicated and self-declared Lamarckian" (p. 190). His 'will to power' mentality assured him "that oaks and other deciduous trees, if planted as seeds, would adapt to the most hostile conditions, flourishing in the dry steppe, and in the salty, semi-arid wildernesses near the Caspian Sea" (p. 190). And he would not allow any reticent scientists to stand in his way.

Another dominant ideology of the time that appealed to the materialist mind was that of eugenics. Married to Malthusian ideas of limited resources for a growing population, the Russian scientist Nikolai Koltsov believed that

> "Eugenics has before it a high ideal which also gives meaning to life and is worthy of sacrifices; the creation, through conscious work by many generations, of a human being of a higher type, a powerful ruler of nature and creator of life. Eugenics is the religion of the future and it awaits its prophets" (p. 142).

The Bolshevik Leon Trotsky prophesied that eugenics would "create a higher socio-biological type, an *Ubermensch* if you will" (p. 418).

These ideas appealed to

> '… many great figures of Soviet biology queuing up to endorse collectivisation—a movement that starved millions to death and was used quite deliberately as a weapon to obliterate an entire class of moderately well-off peasant, decimate the Ukraine, Russia's troublesome satellite, and subjugate the Russian countryside" (i.e. the *Holodomor*, murder by starvation, p. 203; figure 1).

This disdain for the innate value of human life also encouraged such bizarre experiments as efforts to cross-breed a human being with a chimpanzee. In collaboration with the American biologist Raymond Pearl, the world-renowned Ilya Ivanovich Ivanov's work was seen as essential for materialism, as success would "become a decisive blow to religious teachings" (p. 156), in the view of Lev Fridrichson of the Agricultural Commissariat. Ivanov's initial attempts were, of course, conducted away from the public eye in Africa; a 'useful' laboratory, even today, for experiments of dubious value.

Figure 1. Children in Donetsk, Ukraine, dig potatoes out of the frozen ground for transportation elsewhere. A decree in August 1932 forbade peasants from eating their own crops (p. 213).

Marxian motivators

In a totalitarian society under the brutal Stalin, terror was, of course, an obvious tool to force compliance

among any recalcitrant scientists to conform their disciplines to Marxian ideology. Scientists were regularly killed by firing squad (p. 281), and large numbers (along with millions of Soviet citizens) were sent to penal gulags (p. 238), some of which became scientific prison camps where scientists were forced to work on pet projects of the political elite. This strategy was also driven by a desire to industrialize the vast, empty space of Siberia (p. 312).

But there were many other effective methods to manipulate compliance among the scientific community. These methods echo in an eerily familiar manner today. Even in Communist Russia, monetary 'fringe benefits' were used to encourage enthusiastic support of the diktats of the ruling class by scientists. Salaries and funding were largely determined by political usefulness (pp. 93, 96, 97), and cars (p. 372) and mansions (p. 291), and even champagne imported to treat a health condition (p. 374), given to scientific comrades valued by their political patrons.

Scientists could be removed or restored to scientific institutions and associations on a whim (p. 111). Out-of-favour scientists would be labelled as 'counter-revolutionary', 'reactionary', 'fascist' (p. 284), and 'bourgeois collaborators' (p. 362). Honest scientists who raised objections were demonized (p. 341). Sackings were commonplace, with capable scientists left providing for themselves as a gardener or 'ballroom pianist at a club' (p. 369). Dissent was psychologized and dissenters placed in psychiatric hospitals, like the biologist Zhores Medvedev, who was diagnosed as schizophrenic for working in the disparate fields of biology and political science (p. 428). Scientists persisting in genetic studies of fruit flies brought in from America were forced to "revise their work and cease their 'fawning and servility before foreign pseudo-science'" (p. 368). India ink was used to erase the names of famous geneticists (Mendelian) from books where they were mentioned (p. 368) in the library of the Geographical Society. A professor of plant physiology at Moscow University who refused to kowtow to the 'settled science' of the day was exiled from Moscow. He wandered jobless until he shot himself in 1951 (p. 369). Medical students were exposed to more ideological than medical studies (p. 429).

Circus science

This environment was devastating for Russian science. Pride and narcissism carried scientific yes-men into influential positions (p. 215) and fostered a propaganda of ignored reality in science (p. 235).

"Scientific honesty is difficult to achieve" (p. 224), and in such an environment rampant scientific fraud was inevitable and claims increasingly exaggerated and fantastical. Olga Lepeshinskaya, winner of the Stalin Prize, entranced by the mystical idea of 'vital substance', claimed at her prize giving, with filmed 'proof', to have caused living cells to emerge from non-cellular materials. "Actually, she had filmed the death and decomposition of cells, then ran the film backward through the projector" (p. 381). No one at the presentation said a word to contradict such obvious fraud and she was hailed in poems and plays as the "author of the greatest biological discovery of all time" (p. 382).

No-one epitomized this scientific clown show more than the infamous, barefoot, largely self-taught Trofim Lysenko. His experiments with crop plants, including hybridization, vernalization, and acclimatization, and the publicity generated by Soviet propaganda, led him to regard himself as "a new Messiah of biological science" (p. 207). Disdainful of Mendelian genetics, he stated:

> "In order to obtain a certain result, you must want to obtain precisely that result; if you want to obtain a certain result, you will obtain it … . I need only such people as will obtain the results I need" (p. 290).

His Lamarckian fervour made him a favourite with Stalin and led him to such 'amazing' results as "the case of the hornbeam tree that had been persuaded to turn into a hazelnut" (p. 409), which he reported in his own journal, *Agrobiology*, in 1952. In reality, "the branch everyone was getting so excited about had actually been grafted into the fork of the hornbeam" (p. 409).

Real and claimed 'achievements' of Russian science were trumpeted to the masses by a compliant press and film media (pp. 124, 241), and the courts were even used as a "new and effective form of the re-education of the intelligentsia" (p. 349). Set to music by Shostakovich, the propaganda film *Michurin* has the hero wave a flower under the noses of two fat American capitalist professors trying to bribe him, and claim that his flower is a hybrid of violet and lily. He says, "That's the trouble with Mendelians, they can't explain hybrids!" This leads the capitalists to withdraw defeatedly muttering and cursing (p. 386).

Much of the propaganda portrayed the chief scientist Stalin hovering benevolently over all the wonderful scientific achievements (figure 2). A press photograph of a meeting between Stalin and Lysenko showed so-called 'branching wheat', showing promise of feeding a starving nation due to the large number of seeds it produced per plant, but in actuality, branching wheat was

> '… virtually inedible, but it was certainly photogenic, and the message was clear—that Stalin and

his favourite barefoot scientist were again on top of the situation, poised and ready to pull the nation from the brink of catastrophe" (p. 351).

Lessons learned?

As the biblical Christian belief system was the foundation upon which the careful experimentation, observation, and recording of natural phenomena was based, an erosion of that foundation will inevitably lead to the loss of scientific integrity of the scientific method. Due to the devastation of WWII on Russia, and particularly after Stalin's death in 1953, Russian science took a more practical and pragmatic direction. The urgent need to rebuild, feed, and house their starving population, and the space and armaments race against the West, once again began to show the capabilities of Russian scientists. Due to the shortage of scientists, they increasingly enjoyed salaries and fringe benefits almost double that of officials in the Central Committee. Mendelian genetics was tolerated alongside Lamarckian biology. Visitors from the West had to keep a certain healthy scepticism as they would be told of "perennial wheat with prodigious harvests, bacterial treatment of seeds which doubles the yield, new potatoes for the Arctic, and new sheep for deserts" (p. 341).

From the early 1950s onwards, cybernetics began to come to the fore. It was believed that mathematically and technologically driven society, enabled by cybernetics, would be the new umbrella that would provide the longed-for 'one science', subsuming all of society, government, and science (pp. 406, 408). Throughout the world today, cybernetics continues increasingly to take that role, incorporating linguistics, law, and 'scientific government', computing, including AI, information theory, robotics, and increasingly transhumanism.

Conclusion

I first read this book in 2019 and was struck by how many of the corrupt scientific foibles of Stalin's Soviet Union still seemed to be at work in the contemporary scientific world. The past three years have only served to confirm those parallels; the numerous and massive settlements paid by large pharmaceutical companies for their roles in promoting opioid addictions in millions of people; peer-reviewed research published in respected journals that cannot be replicated by third party researchers, and predetermined outcomes attributed to confirmation bias or fraud.

Recent research published in the BMC online journal *Trials*, reported that 62% of randomized biomedical trials were at high risk of bias, 30% were unclear, and only 8% were low risk.[1] It seems that money, pride, politics, and ideology are playing almost as great a role in global science today as they did in the Soviet Union.

And yet the unquestioning faith in the abilities of science to solve all the world's problems continues. It is more technologically advanced, yet no less guilty than the scientism of the Soviet Union.

Figure 2. Russian propaganda portraying Lenin and the chief scientist, Stalin, hovering benevolently over the 'wonderful' scientific achievement of branching wheat.

The biblical basis for the separation of state control from the church, or church control from the state, that has worked so well in recent history, should equally apply to a separation of science and state. The lines between financial benefit, political advantage, and ideological bias, have become increasingly blurred, with massive conflicts of interest intersecting government funding, regulatory bodies, and scientific research institutions. Science in the 21st century would do well to look at the disaster of Stalin's science and pull back from the brink. In the absence of a renewed Christian culture, this is unlikely to happen.

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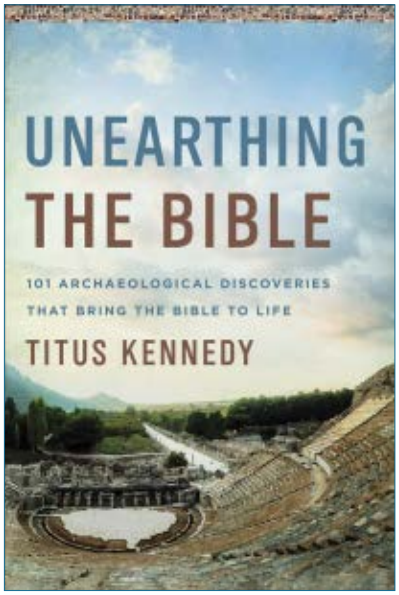
Titus Kennedy really digs the Bible!

Unearthing the Bible: 101 archaeological discoveries that bring the Bible to life

Titus Kennedy

Harvest House Publishers, Eugene, OR, 2020



George LeBret

Secular archaeologists have spent 200 years attempting to establish that the Bible is a collection of mythology and Jewish/Christian propaganda, yet archaeological evidence is more consistent with the Bible as an accurate historical document. In *Unearthing the Bible,* Dr Titus Kennedy isolates and illuminates 101 archaeological discoveries that buttress the thesis that the Bible is a reliable historical record by the traditionally recognized authors at the traditionally accepted times they lived.

Kennedy's book should be in the hands of everyone serious about a historical study of the Bible. Sketching 101 intersections between God's Word and archeological evidence, Kennedy crafts a sturdy structure of information and argument that makes clear that belief in the truth, accuracy, and reliability of the biblical narrative is not merely possible, but it is sensible and rational. Indeed, it takes a full dose of willful blindness and/or intellectual dishonesty to refuse to acknowledge the legitimacy and implications of some of these artifacts. Complete with photographs and translations of ancient inscriptions, a helpful principle of organization, and explanations that are clear and coherent, the book is a genuinely useful tool. No fair-minded reader can deny the book's success in demonstrating that ancient events left behind extensive evidence that the biblical narrative is accurate.

Counterattack

As Kennedy notes on page 9, "the Bible has been routinely attacked and disregarded on the basis of history or archeology." *Unearthing the Bible* challenges those attacks and dismissals head on. The book cites the biblical passages related to each artifact, anchoring the archaeological context with the date and location of each piece's discovery, a note on the biblical period in question, key words, and citations of related biblical passages. The reader's sense and understanding of the relevance of each artifact to the scriptural record grows as the array of archaeological discoveries increases in number and characteristic. In the end, a reader hostile to a biblical worldview may still 'attack', but 'disregarded' is no longer an option.

Names in historical context

Kennedy is careful not to overstate the claims or inferences that follow from these 101 archeological finds featured in the book. On pages 88 and 89, for example, he describes an inscription from an excavation at Khirbet Qeiyafa. The inscription reads, "Ishbaal son of Beda". As Kennedy points out, the name inscribed on pottery may, or may not, refer to Saul's son, Ishbaal, but the inscription (in its archaeological context) performs the valuable function of confirming that the name was in use at the time of Saul's life. Nothing is *proven*, but the archaeological evidence helps suggest that the sources for 1 Chronicles were written near the time of the events it recounts. It is not likely that some writer (or committee of writers) 500 or 600 years later would randomly make up a name that is historically accurate.

In some cases, Kennedy cites a piece of archaeological evidence not as demonstrably connected to a specific biblical character, but as proof that a particular name was, in fact, in use at a particular time. On pages 38–39, Kennedy points out that

> "27 scarab seals bearing the name 'Yaqob' (Jacob) and the element 'El' (perhaps meaning 'protected by God') have been discovered in Egypt, Canaan, and Nubia, dating to around 1800–1600 BC."

He notes that this period is in line with the time of Jacob's migration to Egypt, but that the name was not used either before or after this time. Without trying to make more of the evidence than the evidence allows, Kennedy points out that it is significant that the archeological evidence of the name's use corresponds dramatically with the biblical account.

Altogether, Kennedy cites 19 cases of names used at a time in the Bible that corresponds with the time that a particular name was in common use.

This list contains both Old and New Testament names. Some of these cases have made the popular press, such as the 'James Ossuary' described on pages 224–225. This may, or may not, be the same "son of Joseph and brother of Jesus" that we know in the Bible, but, because all three names are in their proper timeframe and could be common, it certainly is possible.

A more certain name that is found in the Bible and archeology is the title 'First Man of Malta'. Dr Luke the Evangelist referred to a man named Publius as 'the first [man] of the island' in Acts 28:7. The same title was found on an inscription that referred to a man named Prudens as 'the first of the Maltese'. The Prudens reference was dated 30 years earlier than Luke's reference to Publius. Inscriptions from 80 years later under a different Caesar did not use the 'first man' title anymore, but referred to the person in charge of the island as 'the father of the municipality'.

Another name that exactly matches the biblical record is found in ancient Corinth. In Romans 16:23, Paul is passing on greetings to the church at Rome. This is a passage that many people gloss over quickly, because we don't know much about the man Erastus, except that he was a city treasurer in Corinth and that he was associated in ministry with Timothy in Corinth (Acts 19:22, Romans 16:23, and 2 Timothy 4:20). In 1929, an inscription was found in Corinth that reads: "Erastus in return for his aedileship paved it at his own expense." Apparently, the title 'aedile' refers to a city official chosen annually who manages public works and commercial affairs. This is consistent with the title 'treasurer' that Paul uses.

One of my all-time-favourite Sunday School lessons is the story of Balaam and his talking donkey. Not only is this a great lesson on God's sovereignty and faithfulness, but it is an example of a miracle that separates those who believe in God as a miracle worker from those who seek to put the miraculous into a box of natural phenomena. This story is often cited by the latter as an example of the Bible being merely Jewish fiction.

While most people were not really looking for physical confirmation of the events of Numbers 22, the collaborating evidence was found. It appears that Balaam was a historical figure who engaged in the activities described in Numbers 22.

On page 64, Kennedy describes the Deir Alla Inscription. This poetic text was written on a plaster wall just north of where the events of Numbers 22 took place. According to the inscription, Balaam, son of Beor, was called upon to appease certain gods to prevent darkness and chaos. However, it didn't work out in this way, as Balaam and his message were rejected and condemned.

The Deir Alla Inscription is an independent confirmation that a seer named Balaam of Peor was in the area where the events of Numbers 22 took place, and he was there near the time of Numbers 22. Balaam was engaged in the line of work described in Numbers 22.

God is in control

Moses used artifacts as evidence that God was in control of history. Kennedy does not mention the following artifact, because it has not been found outside of Deuteronomy, and Kennedy's book is about artifacts that are physically found and documented. The story of Og illustrates that God was very comfortable using physical artifacts as evidence of His actions. The exodus of the slave class from Egypt and their subsequent capture of established kingdoms with walled and gated cities, was hardly a predictable or likely sequence of events. But 40 years after Israel feared the giants of the land and their discipline was over, God showed them how easy it was for Him to take care of giants. In Deuteronomy 3, Og, king of Bashan was subdued, and, in verse 11, the biblical account makes reference to Og's 4 m- (13-ft)-long iron bed—citing its presence in Rabbah for anyone to see at that time as verification of the historicity of that part of the narrative.

Unearthing the Bible: 101 Archaeological Discoveries that Bring the Bible to Life is a very useful Bible study tool, but, beyond that, Kennedy's book is a collection of convincing illustrations that scientific evidence does not contradict God's Word. Just as biology, geology, chemistry, and physics are consistent with the Bible, the evidence found in archaeology is consistent with the Bible.

As I write this today, Dr Kennedy has released his next book, *Excavating the Evidence for Jesus: The archaeology and history of Christ and the Gospels*. I am eager to discover the biblical truths confirmed in his new book.

Acknowledgments

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In the eye of the beholder

The Manifold Beauty of Genesis 1: A multi-layered approach

Gregg Davidson and Kenneth J. Turner

Kregel Academic, Grand Rapids, MI, 2021

Ting Wang

In *The Manifold Beauty of Genesis 1,* authors Davidson and Turner present various non-literal views of Genesis 1 with a view to avoiding conflict between the interpretations. The authors describe their methodology:

> "In this book, each layer is presented as *complementary* with all the others—no conflict to identify or defend. To accomplish this, we have drawn on the perspectives of various advocates, expanding on some themes and stripping out elements deemed nonessential that create conflict with others. Each layer may thus be said to be 'inspired by' or 'derived from' the work of one or more of advocates, rather than fully representing the position they defend [emphasis in original]" (p. 25).

Seven chapters, entitled 1) Song, 2) Analogy, 3) Polemic, 4) Covenant, 5) Temple, 6) Calendar, and 7) Land, describe the various perspectives. Readers may recognize material derived, for instance, from Meredith Kline's Framework Hypothesis or John Walton's Functional Creation, each view with conflicting elements excluded.

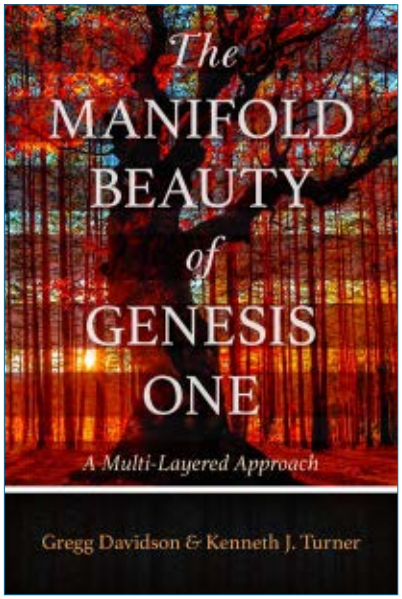
Davidson, professor of Geology and Geological Engineering at the University of Mississippi, is the author of the 2019 book *Friend of Science, Friend of Faith*, which presents his exegetical and scientific evidence against 'literal six-day creation'. It therefore should not be a surprise that the so-called 'literal' or 'plain' view of Genesis is not included among the seven layers in *Manifold Beauty*.

Exegetical methods

The authors assert that "A common theme through each layer in this book will be to understand the text through the eyes of the original audience" (p. 7). But is this a reasonable exegetical expectation? My current-day students sometimes say that they cannot imagine navigating a world without Instagram, Google maps, and YouTube. If it is difficult for my students to see through the eyes of a recent generation, can we really "put ourselves into the mindset and worldview of that original [biblical] audience" (p. 8) and gaze lucidly through the murky mists of millennia?

Another exegetical principle in *Manifold Beauty* contends that "Scripture is without error in all it intends

Figure 1. "And he answered, 'You shall love the Lord your God with all your heart and with all your soul and with all your strength and with all your mind, and your neighbor as yourself.'" (Luke 10:27, ESV)



to teach" (p 10). Note, the authors are not contending that Scripture is without error in all it *teaches*, but rather that Scripture is without error in all it *intends* to teach. But does this not permit interpreters to eisegete their perception of Authorial (and authorial) intent upon the text?

The authors also advocate the exegetical tenet that "The Bible was written *for* us not *to* us [emphasis in original]" (p. 20). But when Jesus says, "Love the LORD your God with all your heart and with all your soul and with all your strength and with all your mind" (Luke 10:27), is this not also understood as being addressed to God's people today? Is it proper to limit God's promise of salvation ("to you and your children and all who are far off—all whom the LORD will call") to the first audience alone? Since promises are generally made *to* people, we can understand the Greek dative case in this way. Similarly, when Jesus tells us that our hairs are numbered and therefore we should not be afraid, is this comforting truth not also spoken to those today graciously granted ears to hear? Scripture is the "living Word" that is written both to and for today's believers.

Defence of the method

Davidson and Turner state that they are "not suggesting something mystical or some sort of free-for-all in which a passage can mean something different for every reader" (p. 4) and deny that they are trying "to make the creation story palatable for those looking to merge the Bible with modern scientific theories of origins" (p. 12). In other words, in the view of the authors, the fact that all seven layers presented in the book are compatible with modern scientific theories of origins (and the literal view rejected), is based on exegetical evidence alone. To those who contend that "the various perspectives presented would never have been considered if we had not given attention to the prevailing scientific theories of the day", the authors "readily acknowledge that observations in God's natural creation have raised questions that drive us to look more deeply at God's written Word." This approach seems to permit an interpreter to change the interpretation of Genesis according to the prevailing scientific theories of the day—confirmation bias is a common phenomenon, and it is very easy to see information that we think we should find in a text. Nonetheless, the authors insist that "The richness discovered, however, is contained within the Bible itself, independent of the truth or falsehood of any scientific theories" (p. 12). As we shall see below, the exegetical evidence the authors present against the literal view of Genesis is not compelling, and one wonders if the authors may be more influenced by modern scientific theories than they recognize in the book.

The authors also assert that the "perspicuity, or clarity, of the Bible pertains to the fundamental message of salvation" (p. 9) and that the doctrine "makes no claim, however, about the clarity or ease of understanding of the Bible as a whole" (p. 9). In response to this, it should be mentioned that the fundamental message of salvation is woven into Genesis 1–3, written by Moses, whom Jesus indicates "wrote about me" (John 5:46). In a very real sense, the entirety of Scripture is a comprehensive message of salvation, from the historical record of God's salvation to wisdom literature (implications and applications of the message of salvation) to genealogies (how the LORD unfolds his plan through the generations). The Lamb who was slain from the foundation of the world is the *logos*, binding together and permeating all of Scripture. In addition, although the Bible may not be easy to understand, Scripture informs us that understanding is granted to those graciously given "eyes to see", as Paul tells Timothy: "Reflect on what I am saying, for the LORD will give you insight into all this" (2 Timothy 2:7).

Blindly literal

The authors maintain a consistently irenic and winsome tone throughout *Manifold Beauty*, except for when they refer to those who hold the literal view of Genesis. For instance, the authors assert that those who hold a literal view of the creation account lack "study and an openness to God's Spirit" (p. 24). Nonetheless, their "hope is that Christians will spend more time in discussions about their *favorite* layers (plural) and less time bickering over which view (singular) should kick all the others out of the theological nest" (p. 12). But in the discussions of favourite layers, the literal view of Genesis is nowhere to be found, relegated to the dustbin as a 'simple' view that fails to recognize the wisdom and beauty of the text.

Figure 2. "Does that look sequential to you?"

Literally problematic

Davidson and Turner state that the straightforward exegesis of the Genesis creation account is replete with 'peculiarities' and 'oddities' (p. 22), which indicate to us that "the intention is more than communicating a sequence of events" (p. 22) in a 'journalistic record' (p. 24). They list four exegetical problems that, in their view, render the plain view of Genesis problematic: 1) Separation of light and dark—twice, 2) Separation of light from the absence of light? 3) Evenings and mornings on a sphere, and 4) The number seven. For reasons of space, we shall briefly respond to exegetical problems 1, 3, and 4 (for problem 2, I think Isaiah 45:7 clearly indicates darkness as a created thing and not merely a privation).

Separation of light and dark—twice

The authors write,

"In Genesis 1:14–18, the sun, moon and stars are created in day 4 for the express purpose of governing the day and night, and 'to separate the light from the darkness.' But 1:3–5 states that light and dark were already separated back in day 1. It may be argued that the separation occurred in day 1 followed by the creation of celestial bodies in day 4 to *govern* that separation, but

this requires a departure from the 'plain' or 'literal' reading. The actual wording of 1:14–18 says the celestial bodies *brought about* the separation of light, making day 4 seemingly redundant [emphasis in original]" (p. 22).

Genesis 1:17–18a reads: "God set them [sun, moon, and stars] in the expanse of the sky to give light on the earth, to govern the day and the night, and to separate light from darkness." The authors believe that the *Hiphil* infinitive of the verb 'to separate' should instead be understood as 'to bring about the separation', but I do not see exegetical/lexical support for this view, and there is none provided in the book. A quick word search indicates that the *Hiphil* infinitive of 'to separate' is next used in Leviticus 10:10, which is translated in the NIV 1984 as "You must distinguish between the holy and the common, between the unclean and the clean". Are we to understand this verse as teaching us that we must 'bring about the distinction' between the holy and the common? Not at all—God has already established this distinction for us. A similar task, distinguishing between light and darkness, already defined and separated by God, is assigned to the sun and moon in Genesis 1.

In addition, the separation of light and darkness occurs *every day* and not just twice during the first week. The reader may also note that God assigns the sun and moon (and stars) the specific tasks of 1) giving light, 2) governing the day and the night, and 3) separating light and darkness. It does not require exegetical gyrations to understand that God initially separated light and darkness on Day 1 and continued to alternate them until Day 4, on which he begins to utilize the sun and moon to accomplish this task (and continues to do so, for God is at work to this very day). The plain view has the additional benefit of communicating the weighty and ever-relevant polemic message that sun-worship is futile, since the sun is ultimately another created object used by God to fulfill His purpose.

Evenings and mornings on a sphere

The authors identify another exegetical peculiarity regarding "three evenings and mornings with no sun" (p. 23):

"The long-recognized problem of three evenings and mornings with no sun is not just the absence of a light source. The earth is a sphere. When it is day on one side of the planet, it is simultaneously night on the other side—perpetually. A rotating planet is half day and half night at the same time. The experience of transition from evening to morning is only possible if standing at a particular location as the planet rotates relative to a fixed light source. For the first three days, no human or animal had yet been created anywhere on the planet, and there was no designated light source. The answer that God was the light does not work, as it requires that (1) he was *not* light before day 1, (2) he was not omnipresent thereafter, isolating his brilliance in one spot, and (3) he simultaneously served as the sole observer from a fixed spot on the earth while placing his light off to one side where the sun would eventually be" (p 23).

Figure 3. The Pillar of Fire, by Paul Hardy, *The Art Bible* (1896)

Since God had already created light on Day 1, the issue of whether or not God served as the light is not pivotal. But, exegetically, God could have served as the light—there are times that God shrouds himself in darkness (2 Samuel 22:12), and Christ did not always shine as brightly as he did during the Transfiguration—but God consistently remains 'light' nonetheless. In addition, God's omnipresence is not nullified by the fact that in Scripture God sometimes localizes His light, as in the aforementioned Transfiguration, but also during the exodus from Egypt:

"By day the Lord went ahead of them in a pillar of cloud to guide them on their way and by night in a pillar of fire to give them light, so that they could travel by day or night" (Exodus 13:21).

In addition, God as light apart from the sun also is the case in the New Jerusalem, as described in Revelation 12:23–25:

"The city does not need the sun or the moon to shine on it, for the glory of God gives it light, and the Lamb is its lamp. The nations will walk by its light, and the kings of the earth will bring their splendor into it. On no day will its gates ever be shut, for there will be no night there."

As mentioned above, an important polemical message of Scripture is that it is futile to bow down to the sun and the moon, since God is the source of light and merely utilizes the sun and the moon to govern the day and the night and to distinguish between light and darkness.

Seven

The authors also point out that Genesis 1 makes repeated use of the number seven (seven days, seven words in Genesis 1:1, 5 x 7 mentions of God, etc.) and suggest that this numerical motif indicates that the text goes

beyond "a simple sequence of events" (p. 24). It should be noted again that those who hold to a plain reading of Genesis see far more in the text than "a simple sequence of events". The authors write, "Something fascinating and wonderful is at work in this text," a fact that is also not unique to non-literal readings of Genesis. The frequent appearance of the number seven in Scripture does not imply that the first seven days are not sequential and historical, any more than the 40 days of Noah's Flood and the 40 days of Jesus' fasting imply that both those events did not unfold sequentially and historically over a period of 40 days each. It should not surprise us that there are recurring motifs in Scripture written by a rational and wise God.

At this time, we come to a brief survey of the chapters devoted to the non-literal views of Genesis.

1. Song (the Framework view)

The authors begin the seven chapters corresponding to the seven 'layers' with the rudiments of the Framework view.

The authors identify Genesis 1:2 as 'troublesome' since it describes "the presence of a world shrouded in darkness and encased in a primordial sea is not preceded by the familiar command 'let there be', nor is it declared to be good" (p. 28). The authors find it 'curious' that "the existence of this primordial soup precedes day 1" (p. 45) and contend that "Modern readers struggle with this description, for it seems out of place. God speaks of something that is present that he must have brought into being, yet it precedes the events of the first day of creation" (p. 28).

But is it exegetically obvious that Genesis 1:2 *precedes* the first day of creation? Genesis 1:3 seems to flow naturally from Genesis 1:2, and there is no suggestion in the Hebrew text suggesting a lengthy temporal gap between verses 2 and 3:

> "Now the earth was formless and empty, darkness was over the surface of the deep, and the Spirit of God was hovering over the waters (Genesis 1:2)."
> "And God said, 'Let there be light', and there was light (Genesis 1:3)."
> "God saw that the light was good, and he separated the light from the darkness (Genesis 1:4)."
> "'God called the light "day", and the darkness he called "night".' And there was evening, and there was morning—the first day" (Genesis 1:5).

Does it stretch the bounds of credulity to see all this as transpiring on the first day?

The authors suggest that the Genesis days are arranged in parallel triads rather than in sequence, aligning Day 1 with Day 4, Day 2 with Day 5, and Day 3 with Day 6, all culminating in Day 7. For each pair of days, the authors identify the general pattern of creation of the realm and then the filling of the realm. The authors admit that the pattern is imperfect and that "the luminaries of Day 4 were placed in the heavens on Day 2 (not Day 1)" and that "the fish from day 5 were placed in the seas of day 3", not Day 2 (p. 37). To my mind, these imperfections are a significant strike against the parallel triad hypothesis and are instead support for the sequential view of the Genesis days, which culminate in God's magnificent Sabbath rest on Day 7. Moreover, items numbered 1–6 are generally understood to be in sequence.

The authors find the separation of light and darkness on Day 4 to be "awkward if intended to be read as a straightforward sequence of creative acts, for it would imply that the separation of Day 1 was ineffective" (p. 31). But cannot the separation of light and darkness on Days 1–3 be read not as ineffective but as different—accomplished by God directly rather than by the instrumentality of the sun and moon, which were not created until Day 4?

The authors identify the unique genre of Genesis 1 as a poetic song, writing that "The wordplay of *tohu wabohu,* imagery of chaos and the great deep, parallel structuring of the days of forming and filling, and intentional use of the number seven all contribute to yield a text that seems remarkably poetic" (p. 33), although "The text exhibits a rich use of poetic *elements,* but is said to fall short of the *form* of poetry" (p. 33).

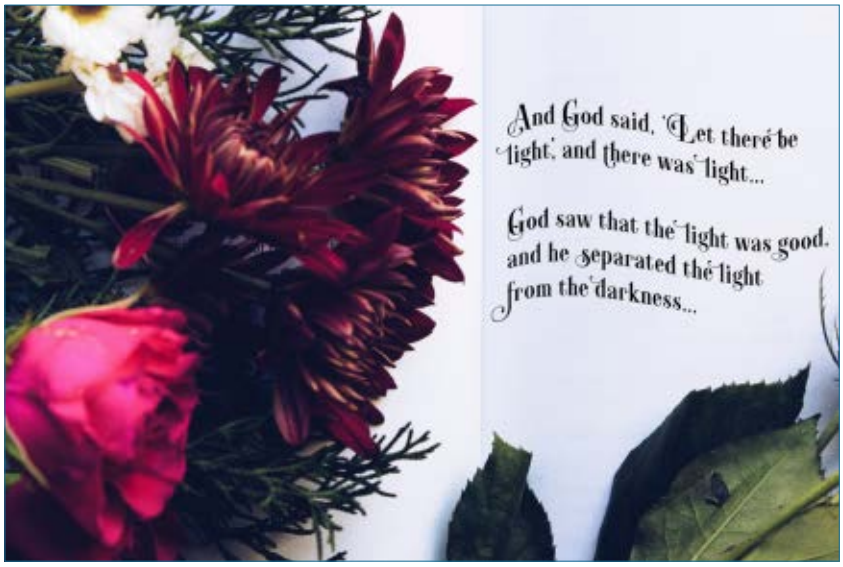


Figure 4. Genesis 1 verses, in adorned poetry presentation

Figure 5. I'm glad God only worked six days during that first week.

The authors also note that because God's name is mentioned frequently in Genesis 1, this suggests that the text is "distinct from normal Hebrew prose" (p. 34, citing Robert Longacre). But should it really surprise us that Genesis 1 should repeat God's name, since Adam and Eve do not come onto the scene until Day 6, and the celebration of God as Creator is a central motif of the chapter (and of the rest of Scripture)?

The authors note the presence of the Hebrew narrative preterite (generally marking sequential events in Hebrew prose) but nonetheless assert that Genesis 1 is not standard Hebrew prose. My own view is that Genesis 1 is standard prose dealing with a most unusual and unprecedented topic—the creation of all things. They suggest that Genesis 1 is the '*firstborn* of songs' (p. 37) and the 'marriage of history and poetry' (p. 37). Whatever one thinks of the genre of Genesis 1, it is important to note that excellent prose in general often includes literary devices such as rhyme and alliteration and wordplay crafted 'on the edge of poetry'. Nonetheless, even if one were to view Genesis 1 as a song, it would not present any significant challenges to the historical and sequential view of Genesis 1, for many songs both ancient and modern recount historical events.

2. Analogy

The second layer that the authors present is entitled 'Analogy' and

> "… is said to represent an unfounded, bidirectional flow of understanding, where humans' *actual* workdays are used as a pattern for describing God's *figurative* creation days, and God's *figurative* creation days are described as a basis for establishing humans' *actual* workdays [emphasis in original]" (p. 51).

In other words, "the creation story taps the human experience of work and rest, patterning the story after a human workweek to illustrate the character of God and his relationship to his creation", and instructs us "how we should understand and value work, creativity, rest and worship" (p. 52). In response, it is not clear exegetically why God's creation days are to be viewed as figurative and the human work week as literal. Cannot both involve literal days? Scripture seems to indicate that God established His "covenant with day and night and the fixed laws of heaven and earth" (Jeremiah 33:25) during Creation Week. Covenants often involve naming rituals (for instance, Abram becomes Abraham during the establishment of the Abrahamic covenant), and God names the light 'day' in Genesis 1. This covenant with day and night, likely established during Creation Week, suggests that the days of Genesis 1 were indeed as literal as the days that comprise the human work week.

The authors contend that "the structure of the story suggests that the real work of creation was not bringing energy and atoms into existence" (p. 45) and state that

> "... the origin of the raw materials of the cosmos doesn't even bear mentioning, as it must be inferred from the opening line. Rather, the *real* work of creation, commencing on day 1, was bringing order and purpose to a disordered and purposeless creation [emphasis in original]" (p. 45).

But why is "bringing energy and atoms into existence" not to be considered real work? Is it correct for an exegete to dismiss God's unprecedented creation of all things *ex nihilo* as not involving 'real' work?

To their credit, the authors recognize a seeming contradiction between Song, the first layer, and Analogy, the second layer. Song posits non-sequential parallel days and Analogy posits figurative but sequential days. The authors assert that "All can be true at once", if not in totality then at least in their primary theses (p. 25), and they "see one message in the sequential ordering of days and another in the parallel structure of days" (p. 52). To my mind the days cannot be both sequential and non-sequential at the same time.

3. Polemic

The authors state incisively that

> "… scholars are in general agreement about the polemical elements in Genesis 1. Where disagreement exists, it is typically on the more nuanced questions of degree and

enumeration: *How intentional* is the polemical edge, and *how many* pagan practices or beliefs are challenged? [emphasis in original]" (p. 65).

In addition, the authors note that "... the polemical aspects of Genesis 1 still carry force in modern times" (p. 73), for "We commonly hear origins stories today, taught as truth, of our universe birthed from the timeless, primordial waters of the multiverse" (p. 73). I found this chapter quite helpful, and, from my own perspective, I believe that Scripture refutes all pagan and unbelieving worldviews past, present and future. Modern cosmology is oftentimes tinged with atheistic Scientific Materialistic presuppositions. It should be mentioned that unlike the seven 'layers' found in *The Manifold Beauty of Genesis One*, the literal view of the Genesis creation days strongly repudiates the godless big bang and evolution hypotheses.

4. Covenant

The authors contend that God's covenant with Noah in Genesis 6:18 was not a new covenant but rather the 'recapitulation' of the earlier 'covenant with creation' (p. 92). They cite the work of Robert Gonzales, who asserts that the verb in the biblical idiom 'to cut a covenant', when used in the *hiphil*, denotes not the '*inauguration*' of a covenant but rather "*the fulfillment of a prior obligation or commitment* [emphasis in original]" (p. 84). But is it the case that the *hiphil* of the verb 'cut' necessarily indicates the continuation rather than the establishment of a covenant? For instance, in Genesis 17:7, God says to Abram

> "I will establish ['cut'] my covenant as an everlasting covenant between me and you and your descendants after you for the generations to come, to be your God and the God of your descendants after you."

God's covenant with Abraham does not seem to be a recapitulation of an earlier covenant, despite the text's

Figure 6. Medium rare, please.

using the *hiphil* form of the verb 'to cut'.

The upshot of this 'recapitulation' perspective is that the authors posit that there was death before the Fall and that "Cursed is the ground because of you" (Genesis 3:17) does not imply that "creation was corrupted by sin" (p. 89). The authors insist that that notion of "nature corrupted by human sin did not develop until the Renaissance, *fourteen centuries* after Christ [emphasis in original]" (p. 89). Since the Noahic covenant included eating meat, and since the Noahic covenant is theorized to be a recapitulation of the 'covenant with creation' already present in Genesis 1, the authors posit death before the Fall, which aligns with viewing the Genesis days as non-literal. I think it is important to note that the 'meat-eating' aspect of the Noahic covenant is specifically indicated to *not* be a recapitulation but something new: "Everything that lives and moves will be food for you. Just as I gave you the green plants, I now give you everything" (Genesis 9:3). The *now* of the dietary stipulations in the Noahic covenant clearly indicates that this is not a mere restatement of prior guidelines.

5. Temple

This chapter distills the 'functional creation' view of John Walton described in *The Lost World of Genesis One* in which Walton makes the claim that

> "Genesis 1 is not an account of material origins but an account of functional origins, specifically focusing on the functioning of the cosmos as God's temple" (John Walton, *The Lost World of Genesis One*, p. 92).

Walton's dismissal of material creation as described in Genesis 1 seems to run counter to verses such as Isaiah 66:2 in which, with reference to the heavens and the earth, the LORD asks, "Did not my hand make all these things, so that they came into being?" Similarly, in John 1:3, we learn that "all things were made" through the *Logos* "in the beginning." Moreover, Romans 1:20 indicates that "since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made." What has been made, what can be seen, declares the glory of God. Promisingly, authors Davidson and Turner do "find ample

Figure 7. Architectural model of the temple of King Solomon in Jerusalem

evidence in the biblical story for God's interest in material things" (p. 105).

Nonetheless, since *The Manifold Beauty of Genesis One* focuses on points of agreement, the authors present the temple perspective, which posits that Genesis 1 is an inauguration ceremony celebrated annually in ancient Israel with a view to commemorating God's functional preparation of the cosmos as a temple for his habitation. In response, although Scripture describes the heavens and earth as God's throne and footstool (Isaiah 66:1), the archetypical temple is in heaven (Hebrews 8:5) and God's saving work is connected to a temple specifically not of this creation:

> "When Christ came as a high priest of the good things that are already here, he went through the greater and more perfect tabernacle that is not man-made, that is to say, not a part of this creation" (Hebrews 9:11).

Much can be said about Walton's exegetical presuppositions, and we will just mention some of them briefly. Walton asserts that the Bible "must be understood as just another piece of ancient mythology" (*The Lost World of Genesis One*, p. 12), with 'mythology' defined as that which explains how the world works, and that "reading the text as ancient literature offers the most hope for treating the text with integrity" (*Lost World of Genesis One*, p. 105).

Walton asserts that "Genesis narratives are not God's narratives" but rather are "human narratives that carry God's authority" (Walton, "Is Genesis real history?" article posted on isgenesishistory.com), and that the 'temple' view "may be a way to interpret Scripture faithfully that will allow [people] to hold on to both science and faith" (John Walton, *The Lost World of Adam and Eve*, p. 210). In response, let us briefly contend that Scripture is ultimately God's narrative and, as the "living and active" Word, transcends categorization as ancient literature. Moreover, Scripture teaches us that God created material things "in the beginning" for His glory and that the earthly temple was not a microcosm of the cosmos but was instead "a copy and a shadow" (Hebrews 8:5) of a heavenly prototype. In addition, one best holds on to both science and faith by viewing fallible science through infallible Scripture.

6. Calendar

This perspective, which derives from the work of Michael LeFebvre, begins promisingly. The authors state, "As God, so Israel. The nation was to pattern its six-plus-one rhythm of work and rest after the description of God's workweek, culminating in the divine Sabbath on the seventh day" (p. 122). So far, so good. The only thing I would add is that God's work week is not mere description but is actual historical fact.

Nonetheless, over the course of a few pages, "As God, so Israel" transmogrifies into "As Israel, so God." The authors cite Lefebvre, who writes: "The creation week narrative contains the history of God's ordering of the world, mapped to Israel's observance schedule for stewarding that order with labor and worship" (p. 123; citation from Lefebvre, *Liturgy of Creation*, p. 116). Humankind in the image of God is one thing—a correct thing—but a god who maps his schedule after that of humans is quite something else entirely.

In Exodus 20:9–11, the LORD commands Israel:

> "Six days you shall labor and do all your work, but the seventh day is a Sabbath to the LORD your God. On it you shall not do any work, neither you, nor your son or daughter, nor your manservant or maidservant, nor your animals, nor the alien within your gates.
>
> For in six days the LORD made the heavens and the earth, the sea, and all that is in them, but he rested on the seventh day. Therefore the LORD blessed the Sabbath day and made it holy."

The word translated 'For' at the beginning of verse 20:11 is the Hebrew word 'כִּי', a causal conjunction used with hypotaxis and not parataxis, meaning that order matters—the latter provides the cause for the former and the former depends upon the latter. Exegetically, the human work week is unmistakably patterned after God's Creation Week.

Nonetheless, LeFebvre's perspective practises 'backward reading" (p. 126) and asserts that the 'stories' of Genesis are instead modelled upon Israel's 'festival-calendar'. For instance, the

authors point out that Noah's Flood lasts for "both five months and 150 days" (p. 129), a description which the authors suggest points to 'symbolic intention' in the Flood story which corresponds to significant dates and festivals within Israel's later agricultural year.

The authors apply the same methodology to the Creation Week of Genesis 1:

> "It is a microcosm of each agricultural year of preparing the soil, planting, harvesting, and celebrating God's provision with feasts and holy days, repeated on a weekly cycle. The purpose is liturgical. … a year-in-microcosm for the divine farmer" (p. 134).

The authors see Genesis 1 as portraying God 'in overalls' (p. 136), the evenings and mornings as 'figurative' and once again disparage the historical and sequential reading of the creation days as 'wooden' (p. 136).

In my view, the 'backwards reading' approach is somewhat analogous to the logical fallacy of 'affirming the consequent'. Once again, the order has been switched.

7. Land

In this perspective, the authors assert that "the story of creation is not the background leading up to Israel's story. It *is* Israel's story" (p. 144). Despite the fact that the specific words of Genesis 1 refer to universal creation, the authors view it as 'localized':

> "While most view the days of creation as describing the entire planet and cosmos, the days can also be understood more specifically as describing the preparation of the local landscape, Eden, for human habitation" (p. 144).

The universal has become local, and the comprehensive has become specific, and all manner of problematic interpretations result.

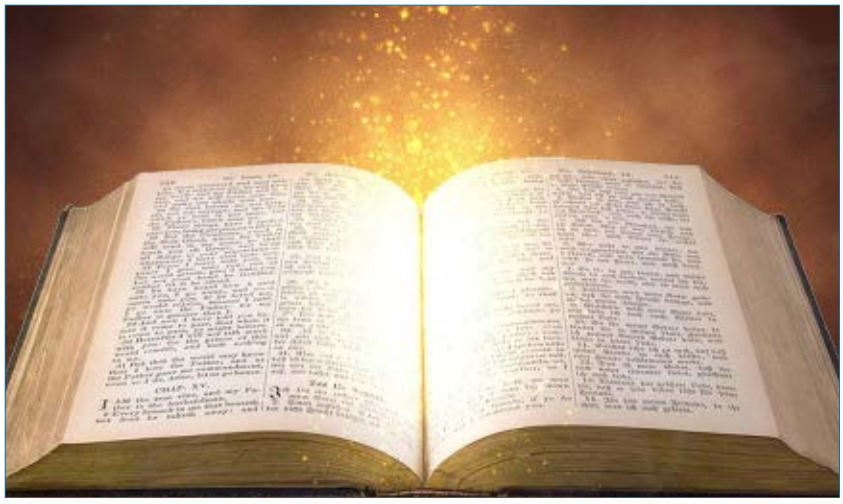


Figure 8. Consider that Scripture was written to and for all of God's people diachronically, to those to whom God has graciously granted eyes to see and ears to hear.

Conclusion

The authors contend that "Scripture was written *to* a specific people at a specific time" and "intended *for* believers at all times and places". On the other hand, I think that readers might do well to consider a different perspective—that Scripture was written to and for all of God's people diachronically, to those to whom God has graciously granted eyes to see and ears to hear.

Overall, the book is written in excellent, succinct prose and contains arguments that are clear and easy to follow. The authors consistently remain 'in the pocket', helping to make the book a pleasure to read. The book provides a helpful survey of the current major non-literal views of Genesis 1.

Nonetheless, the material omitted from *Manifold Beauty* is essential. First, there is the pivotal issue of the literal and historical view of Genesis 1 being excluded from among the possible interpretations. Second, the approach that involves "stripping out elements deemed nonessential that create conflict with others" (p. 25) may hinder readers from developing a more comprehensive understanding of the strengths and weaknesses of each perspective. To really evaluate a viewpoint, readers will likely need to consider not only areas of agreement but also areas of disagreement.

As mentioned above, the authors "readily acknowledge that observations in God's natural creation have raised questions that drive us to look more deeply at God's written Word." For those holding to the absolute authority of Scripture, these empirical observations should be interpreted through the lens of divine sovereignty, providence, and miracle, with science subordinate. Paul reminds us: "Where is the wise man? Where is the scholar? Where is the philosopher of this age? Has not God made foolish the wisdom of the world?" (1 Corinthians 1:20). By the grace of God, let us together "tremble at God's word" (Isaiah 66:2), despite resulting conflicts with the wisdom of the world.

The Precambrian: globally correlated and all Flood deposited

Maxwell Hunter

Rocks of the Precambrian *cratons*, including the exposed Precambrian *shields*, comprise some 71% of the Earth's total land area. Extensive study of exposed Precambrian strata, motivated by its content of valuable minerals, has resulted in the accumulation of copious geological information on the Precambrian. This information can be used by creationists to incorporate all of the Precambrian into a Genesis Flood geologic model. There are abundant products of volcanism, including explosive volcanism, and volcanic lava sequences up to 22 km thick, throughout the Precambrian geologic record. Superpositional relationships of distinct lithological associations enable global correlation of early Precambrian strata. A Genesis Flood geologic model is proposed wherein the Flood cataclysm was initiated by a sudden reduction of gravitational force which decompressed the earth's hot, water-saturated mantle. The Precambrian rock record was extruded from the mantle and deposited during Day 1 to Day 40 of the Flood cataclysm. Widespread evidence of destructive volcanic geologic activity throughout the Precambrian corroborates the Scriptural record of the destruction of the created earth (*'eretz*) by the Flood cataclysm (Gen. 9:11). This should lead us to preclude a Creation Week or Antediluvian origin for the Precambrian geologic record, and instead consider all of the Precambrian as Flood deposited.

Abundant economically exploitable deposits of gold, silver, copper, nickel, iron ore, and other commodities occur in Precambrian rocks throughout the globe. Groves and Barley note: "Archean terrains are some of the most richly mineralized on Earth".[1] Extensive exploration and study of the Precambrian by workers in both industry and academia have resulted in an extensive accumulation of geological information. Creationists can use this information to incorporate the Precambrian into a young-Earth Genesis Flood geologic model.

The place of the Precambrian in a young-Earth Genesis Flood geologic model has been discussed at length by creationist writers. Much of this discussion has been based on observations of the very spatially and stratigraphically limited Precambrian exposures in the Grand Canyon (figure 1). Creationists have entertained three main opinions regarding the origin of the Precambrian rock record and the location of a pre-Flood/Flood boundary in the global geologic record, viz.:

1. all Precambrian is Flood deposited[2,3]
2. lower (so-called 'non-fossiliferous') Precambrian is pre-Flood, and upper ('fossiliferous') Precambrian is Flood deposited[4,5]
3. all Precambrian is pre-Flood.[6,7]

In this paper, I consider some of the products of volcanic geological processes that were active during deposition of the Precambrian rock record and highlight their occurrence throughout the Precambrian. The Precambrian and Phanerozoic geologic records, the Precambrian fossil record, and the multi-celled 'animal' fossil assemblages of the late Precambrian *Ediacaran Biota* and the basal Cambrian *Cambrian Explosion* are incorporated into a gravitational decompression–recompression Genesis Flood geologic model. Abundant evidence of destructive geological processes in the Precambrian, including explosive volcanism, corroborates the scriptural record of destruction of the created earth (*'eretz*) recorded in Genesis 6:13.

Precambrian explosive volcanism

Figure 1 shows the global distribution of Precambrian cratons (green and black) and exposed Precambrian shields (black). Precambrian cratons are the stable interior portions of the continents, and the Precambrian shields (e.g. Canadian Shield) are the main exposures of Precambrian strata within the cratons. Perhaps significantly, the Mountains of Ararat (Urartu), where many consider the Ark grounded, are situated mid-way between the Central European Craton and the African Craton. Goodwin[8] estimates the total area of buried and exposed Precambrian continental crust (cratons) is about 71% of the earth's total land area. He estimates the exposed Precambrian continental crust (shields) at about 20% of the total land area (figure 1).

The Precambrian geologic record (figure 2) contains widespread products of volcanism,[9–11] including explosive volcanism. The mid to lower so-called 'non-fossiliferous' portions of the Precambrian comprise extensive massive ultramafic to mafic to felsic volcanic assemblages up to 22 km thick, preserved in Archean greenstone belts (figure 3). Greenstone belts are the typical tectonic element of the

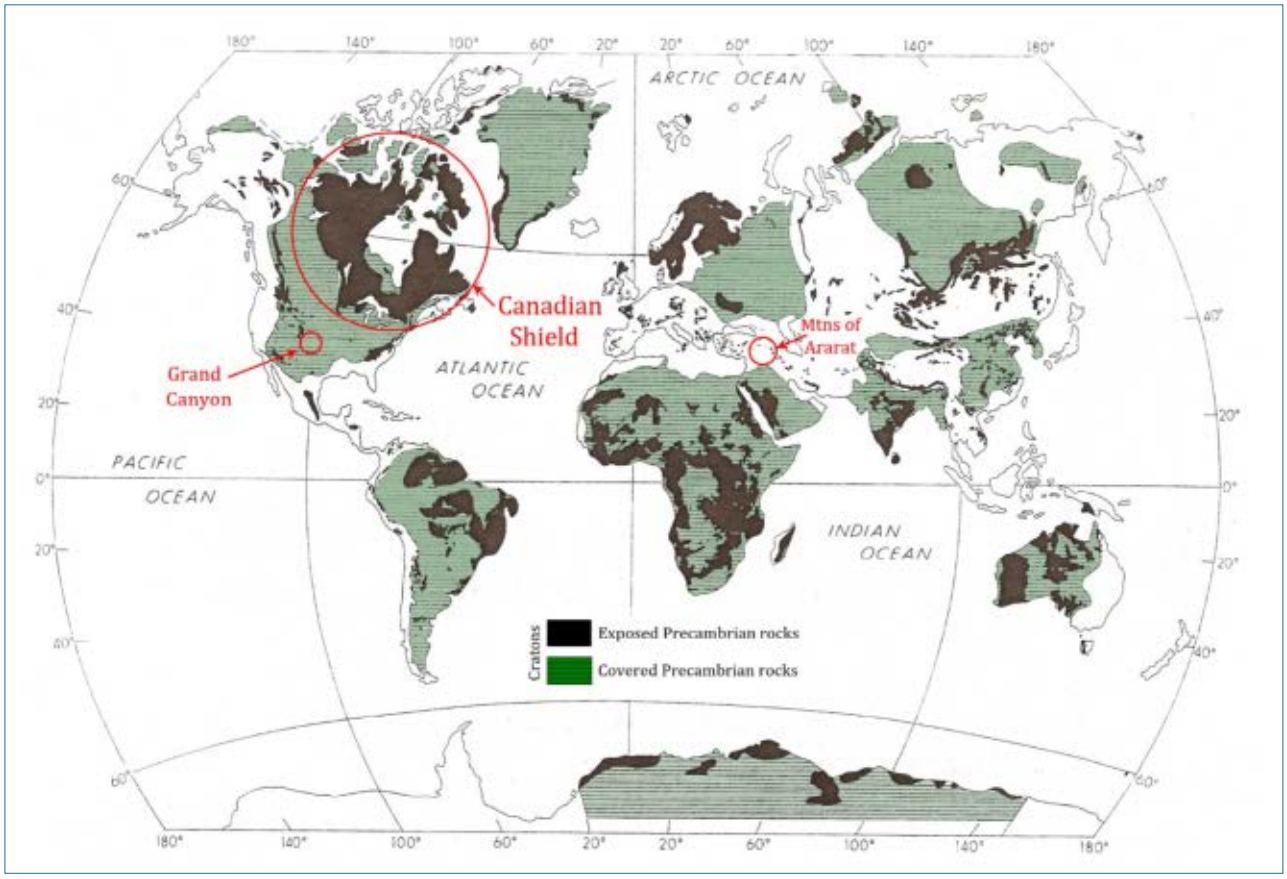


Figure 1. Precambrian cratons, comprising covered Precambrian (green) and exposed Precambrian shields (black), Canadian Shield and Grand Canyon. Note: 'Mountains of Ararat (Urartu)' midway between the Central European and African Cratons. (After Goodwin.[8])

Archean.[8,12] The Paleoprotozoic of Salop[13] is equivalent to the greenstone belts of other writers (figure 4).

Explosive volcanic eruptions occur when gas dissolved under pressure in highly viscous magmas violently froths into volcanic ash upon release of pressure at the volcanic vent.[14] Such eruptions can send a superheated eruption column or plume of ash, dust, gas, fragmented lava, rocks, lapilli, lava bombs, and pyroclastic material (collectively 'tephra') up to 40 km into the atmosphere at up to 100,000 tonnes per second at several hundred metres per second (figure 5).

Products of explosive volcanism, indicative of destruction, found in the Precambrian rock record include:

1. *Pyroclastic Flows*, which occur when the ejected column from an explosive volcanic eruption, comprising hot gasses and tephra, collapses back to the ground and flow rapidly along the ground surface away from the volcano. Hot pyroclastic flows can reach temperatures of 300–400°C and flow at speeds of up to 180 km/h.[15]
2. *Pyroclastic Rocks* (figure 5), made up of >75% by volume of pyroclastic volcanic fragments derived from explosive volcanic activity. 'Tephra' is the unconsolidated equivalent of pyroclastic rocks.[16]
3. *Volcaniclastic rocks* are clastic rocks composed of broken fragments of volcanic rock resulting from any mechanism of fragmentation, transportation, or depositional environment. They may contain non-volcanic particles in any proportions.[17]
4. *Tuffs* are rocks formed when ash ejected by an explosive eruption falls back to the ground surface and is lithified. Air-fall tuffs are compacted rocks with fine- and coarse-grained varieties, in places showing a well-defined stratification. They are composed predominantly of lithic and crystal fragments embedded in a fine-textured matrix, composed of volcanic ash and dust.
5. *Ignimbrites* (or pumice-flow deposits) are deposits formed from pumiceous pyroclastic flows. Ignimbrites may be welded or non-welded and some ignimbrites are the largest eruptive units known, with volumes up to 1,000 km^3. Ignimbrite formation has been described as "*the most cataclysmic of all geological phenomena* [emphasis added]."[18]

6. *Agglomerates* are pyroclastic igneous rocks which comprise mainly angular or rounded lava fragments in a tuffaceous matrix, also described as "a coarse pyroclastic deposit composed of a large proportion of rounded fluidally shaped, volcanic bombs."[19]
7. *Accretionary Lapilli* are small, roughly spherical balls which form by accretion of fine ash around condensing water droplets or solid particles, particularly in steam-rich volcanic eruptive columns.
8. *Lapillistone* comprises lithified aggregates of accretionary lapilli.[20,21] Significantly, regarding the Creation Week environment, the processes necessary for the formation of lapillistone deposits include volcanism, ash columns, moisture, nucleation, accretion, deposition, and lithification.

Some Precambrian volcanic accumulations

Annhaeusser described massive stratigraphic thicknesses of early Precambrian volcanic lava sequences in greenstone belts in Australia, Southern Africa and Canada, and wrote as follows:

> "Archaean greenstone belts are characterized by *tremendous accumulations of volcanic and sedimentary rock types*. In Western Australia for example, thicknesses of approximately *30,000 m* and *18,000 m* are reported by McCall (1968) and Glikson (1968). In the Barberton belt the total thickness of the pile is in excess of *20,000 m* (Viljoen & Viljoen, 1969d) while in Canada thicknesses ranging from *7,500 m* to *12,000 m* have been reported by Wilson et al. (1965), Baragar (1966), and Goodwin, (1968) [emphases added]."[22]

Annhaeusser recognized "a regular and systematic pattern of greenstone belt stratigraphic evolution"[23] and erected a "hypothetical Archaean stratigraphic column" to illustrate the main components of a fully developed Archaean greenstone belt (figure 3).

The basal *Ultramafic Group*, typically 7,500 m thick (e.g. Onverwacht Gp. of Swaziland), comprises ultramafic peridotitic komatiites and mafic basaltic komatiites. Other lithologies characteristic of the basal Archaean stratigraphic pile include tuffs, tholeiitic lavas, intrusive ultramafic bodies and soda-rich quartz and felspar porphyries.

The *Greenstone Group*, typically 7,200 m thick (e.g. Bulawayan Gp. of Zimbabwe), comprises mainly mafic to felsic rocks, such as tholeiitic basalts, andesites, dacites, rhyodacites, and rhyolites. Other lithologies include mafic to felsic pyroclastics, indicative of explosive volcanic activity, cherts, banded ironstones and jaspilites. There is a gradational increase in acidity of volcanic rocks with height in the Greenstone Group column.

The terminal *Sedimentary Group*, typically 3,500–5,250 m thick (e.g. Fig Tree and Moodies Groups of Swaziland),

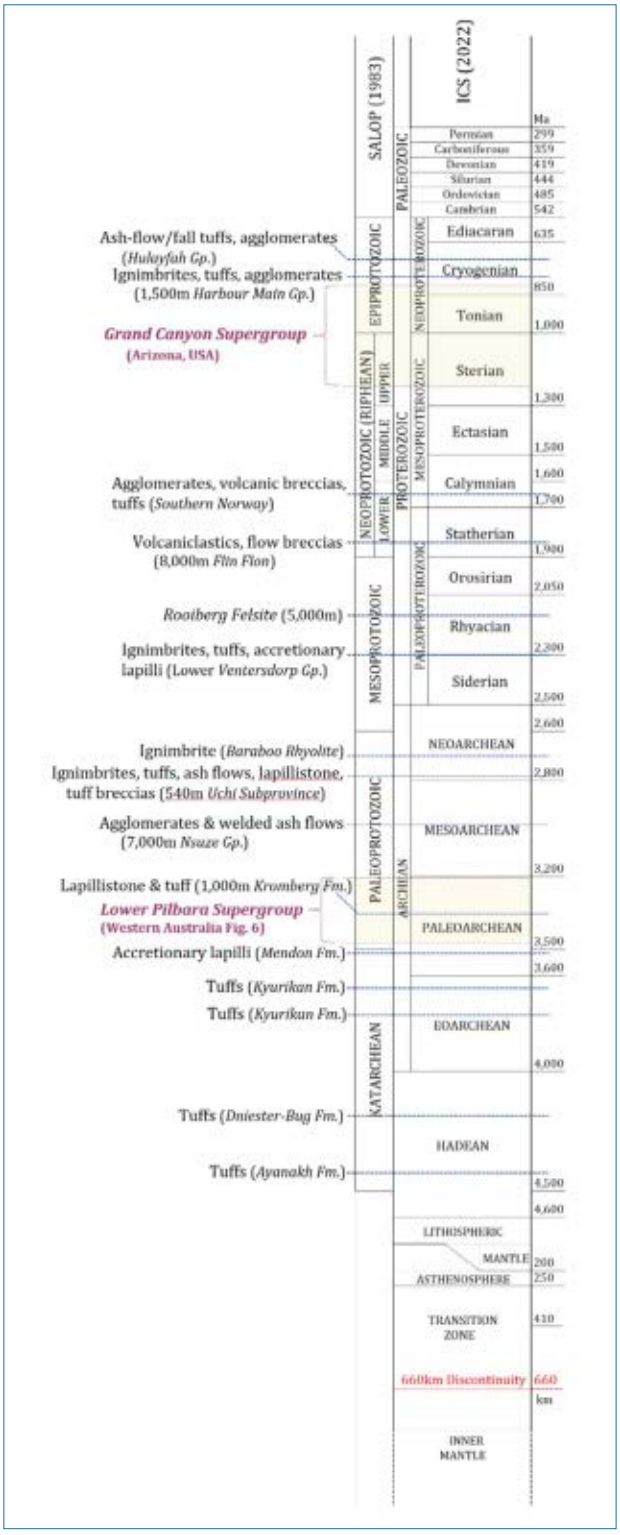


Figure 2. Precambrian stratigraphic columns of Salop[13] and International Commission on Stratigraphy.[56] They include the Katarchean and Paleoprotozoic (Greenstone Belts) stratigraphic compilations of Salop, the stratigraphic positions of Grand Canyon Supergroup and Lower Pilbara Supergroup, and the stratigraphic positions of products of volcanism, including explosive volcanism throughout the Precambrian.

comprises a lower *argillaceous assemblage* and an upper *arenaceous assemblage*. The lower argillaceous assemblage comprises greywacke, shale, grit, minor conglomerate, banded chert, banded ironstone, jaspilite, and minor volcanics and pyroclastics. The upper arenaceous assemblage comprises conglomerates, boulder beds, subgreywacke, siltstone, shale, banded ironstone, jaspilite, and minor volcanic and pyroclastic rocks.

Komatiites are distinctive ultramafic lavas which characterize the earliest Precambrian strata (figure 3). Komatiites were extruded at high temperatures (1,600°C) as a result of partial melting deep in the mantle. Arndt wrote as follows regarding the depth to the source of komatiite lavas:

> "… a komatiite magma with 30 wt% MgO and an eruption temperature of 1600°C should have segregated from its source at a depth of over 200 km, and this source would have started to melt at some depth greater than 400 km … and … *may have come from a deeper thermal boundary layer, perhaps at 670 km* [emphasis added]."[24]

Salop noted that rocks of his *Katarchean* Erathem (figure 4) are "exceptionally widespread on every continent".[25] Characterized by high-grade metamorphism, granitization, and migmatization, the Katarchean is principally represented by mafic and ultramafic metavolcanics, with metasedimentary rocks (quartzites) in lesser abundance.

Postulating a scenario suggestive of a global flood, Salop noted regarding the environment of sedimentation in the earliest Precambrian:

> "A striking consistency in composition and sequence of the extensive Katarchean supracrustals shows a uniform environment for their formation. The lack of … any traces of existence of older land (areas of erosion) is suggestive of the fact that *sedimentation and lava outflow occurred in a huge ocean, Panthalassa, that at times covered the major part of the earth's surface or the whole planet* [emphasis added]."[26]

Salop noted that we can reach conclusions regarding the tectonic environment that governed the earliest stages of the formation of the geologic record. The tectonic pattern of these earliest *high-grade* metamorphosed Precambrian strata is typified by large round or oval domal structures called *gneiss fold ovals*, which, Salop said,

> "… are likely to have originated as a result of the rising of a great mass of mobilized and partially rheomorphic matter (rheon) of the earth's crust. The great size (up to 800 km across) of the structures is suggestive of *a source of energy at significant depth, probably in the upper or even in the middle mantle* [emphasis added]."[27]

Regarding the rising of matter through the mantle during the earliest Precambrian, Salop noted:

> "The cause of the rheon uplift lies in *the irregular movement of the heat from the interior of the planet toward its surface* [emphasis added]."[28]

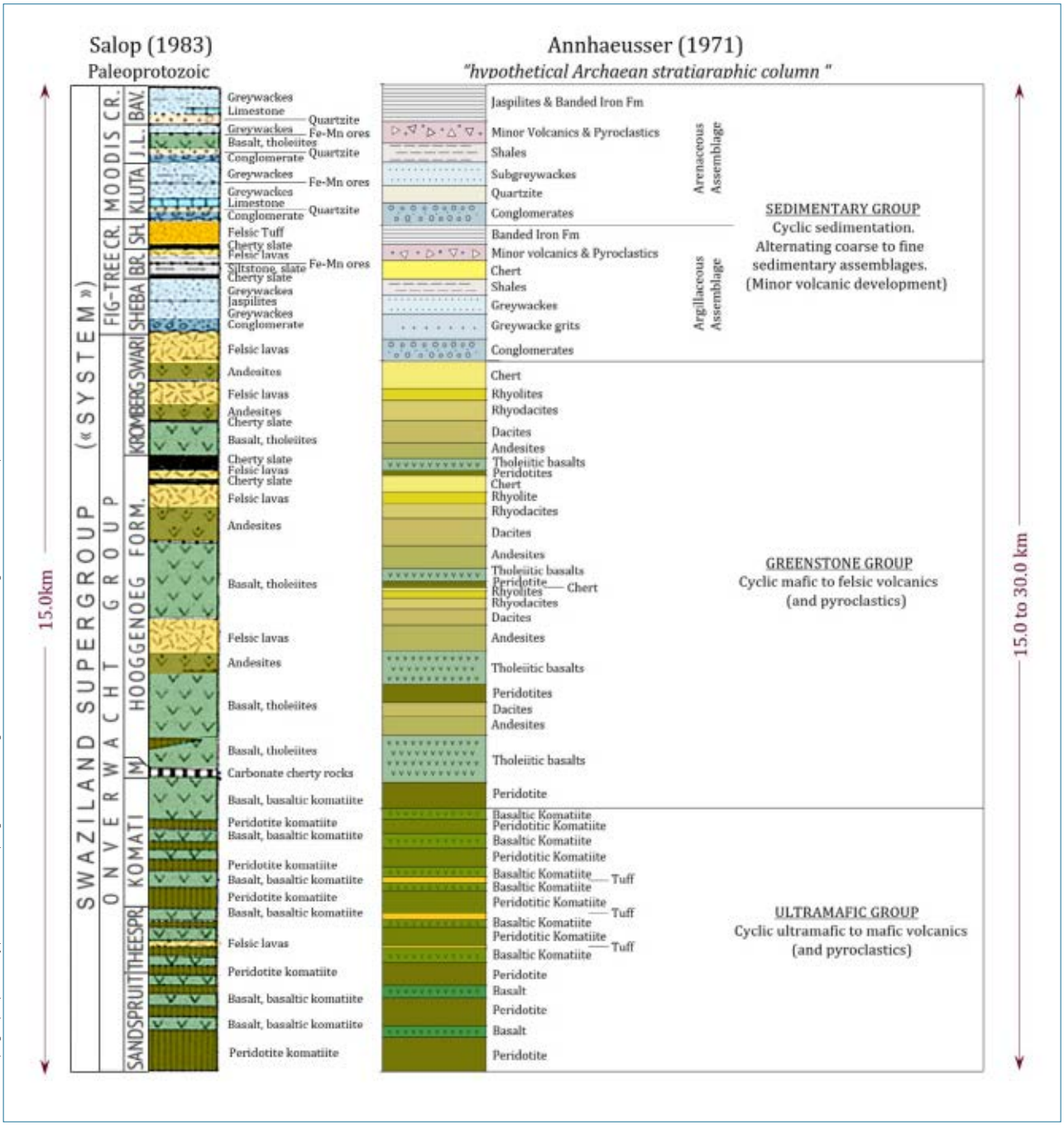
The Aldan Group in the Aldan Shield of Siberia (figure 4) is regarded as the stratotype of Salop's Katarchean Erathem and comprises four complexes, described as follows:

1. Basal *Iyengran* metabasite–quartzite complex (5,300–6,500 m thick) comprises basic pyroxene schists and amphibolites after mafic lavas, alternating with thick quartzite horizons, with interlayers of sillimanite gneisses and rare magnetite rocks. Tuffs occur in the Ayanakh and Dniester-Bug Formations.
2. *Ungran* metabasite complex (2,400–3,800 m thick) comprises melanocratic pyroxene and amphibole schists and amphibolites formed from mafic and partly ultramafic volcanics. Rare thin interbeds of silicate-magnetite and quartz-magnetite rocks also occur.
3. *Fedorovian* metabasite-carbonate complex (5,500–7,000 m thick) is typified by metabasites with interbedded marbles and calc-silicate rocks. Graphite bearing gneisses, thin interbeds of quartzites, aluminous gneisses, and banded silicate-magnetite and quartz-magnetite rocks also occur. The complex hosts deposits of graphite, iron, manganese, and phosphorus. Tuffs occur in the Kyrurikan Formation.
4. Topmost *Sutamian* complex (2,000 m thick) is principally composed of fine bedded biotite gneisses (originally pelitic sediments) and coarse bedded garnet granulites with subordinant metabasites, marbles, and high aluminous gneisses.

The total thickness of the Aldan Group is thus some 15.0 to 19.0 km. Some 13.0 to 17.0 km of this assemblage comprises metamorphosed mafic and ultramafic lavas.

A similar pattern of volcano-sedimentary development is also illustrated in Salop's globally correlated Paleoprotozoic Erathem (figure 4). Salop[13] noted that the three main successive groups of Annhaeusser's 'hypothetical Archaean stratigraphic column' (figure 3) are known on every continent. Equating his Paleoprotozoic Erathem to Annhaeusser's hypothetical column, Salop recognized the two parts of Annhaeusser's uppermost Sedimentary Group and divided his Paleoprotozoic Erathem into four parts, as follows:

1. The basal *Komatian* (3,500 m thick) principally comprises ultramafic and mafic volcanics with peridotite and basalt komatiites dominant. Subordinate rocks include clastic rocks formed by destruction of crystalline rocks of the Katarchean basement. Also, some greywackes, polymict conglomerates, slates, and tuffs.
2. *Keewatinian* complex (7,000–8,000 m thick) largely built up of volcanics alternating with pyroclasts, with subordinant sedimentary rocks, including greywackes, slates, cherts, jaspilites, carbonate rocks. The lower part is typified by mafic lavas, tholeiitic basalts, and diabases and rare spilites with pillow structures. The upper part comprises



Swaziland Supergroup reprinted by permission from Springer Nature: *Geological Evolution of the Earth During the Precambrian*, Salop, L.J., 1983.

Figure 3. *Swaziland Supergroup* (after Salop[13]) and hypothetical Archaean stratigraphic column (after Annhaeusser[12]). Note basal ultramafic high temperature, high magnesium komatiites, and peridotites. Published by permission of Springer Nature and Geological Society of Australia Inc.

intermediate and acid lavas, including dacites, albitophyres, rhyolites, andesites, and abundant pyroclastic rocks.

3. *Timiskamingian* (2,000 m thick) comprises mainly clastic rocks, including greywackes, slates, tuffogenic and arkose sandstones, cherts, rare quartzites, jaspilites, with polymict conglomerates at the base, and subordinate acid volcanics and pyroclastic rocks.
4. Uppermost *Moodies Complex* (3,100 m thick) comprises principally sedimentary rocks, characterized by abundant conglomerates, sub-greywackes, quartzites, calcareous sandstones, dolomites, and limestones.

The total thickness of Salop's Paleoprotozoic Erathem is thus some 16.0 km. Some 11.0 km of that assemblage comprises dominantly ultramafic and mafic lavas.

Goodwin[8] describes the Swaziland Supergroup of the Barberton Greenstone Belt in the Kaapvaal Craton of southern Africa as follows:

1. The basal *Onverwacht Group* (12,000 m thick) comprises, in its lower part, ultramafic and mafic rocks, abundant pillowed and massive lava flows and sills of peridotite and basalt (komatiite, high-Mg basalt, and tholeiite) with subordinate interlayered felsic tuff, agglomerate, and ironstone.
2. The upper *Onverwacht Group* comprises mafic to felsic volcanic lava flows and pyroclastic rocks with thin chert and carbonate units. Interbedded sedimentary deposits include gravel, sand, silt, and dolomite.
3. The overlying *Fig Tree Group* (2,000 m thick) comprises dominantly greywacke and shale with subordinate chert, BIF (banded iron formation), and pyroclastic rocks. The uppermost *Moodies Group* (3,500 m thick) comprises more mature arenaceous sediments, basal conglomerate, and arkose, subarkose, quartz arenite, shale, and banded iron formation.

The total thickness of the Swaziland Supergroup is thus 17.5 km. Some 12.0 km of this assemblage comprises dominantly ultramafic and mafic lavas, with subordinate products of explosive volcanic eruptions, including tuffs, agglomerates, and pyroclastic rocks.

Twist[29] described the Rooiberg Felsite[30,31] of the Bushveld Complex of southern Africa, which comprises dacitic, rhyodacitic, and rhyolitic lavas, and silicic andesites. The felsite unit also contains intercalated sedimentary and pyroclastic rocks, ash-fall tuffs, volcanic breccias, and ignimbrites. The ignimbrites and laminated ash-fall tuffs probably represent initial explosive volcanic activity preceding lava eruptions. Locally exceeding 5.0 km thickness, the Rooiberg Felsite may represent an erupted volume in excess of 300,000 km^3, making it among the largest accumulations of silicic volcanic rocks known.

Thurston and Ayres[32] describe the volcanic lithologies of the Archaean-mafic-dominated Flin Flon greenstone belt, Canada. Here, subaqueous and subaerial amygdaloidal lava flows are intercalated with mafic volcaniclastic rocks. In the Amisk Lake area, an 8.0 km stratigraphic thickness of volcanic lithologies includes sheet and pillowed lava flows, flow-foot breccias, tuffs and lapilli tuffs, fall and surge tuffs, and tuff breccias.

Lowe[33] noted that thick lenticular units of basaltic lapillistone and tuff representing accumulations of coarse mafic fragmental volcaniclastic debris erupted from shallow subaqueous or subaerial vents in the Barberton Greenstone Belt. He also noted a unit of fall-deposited mafic lapillistone in the Kromberg Formation that reaches 1,000 m thick and shows massive fall-deposited and current-worked cross-stratified facies.

Watchorn and Armstrong[34] describe the 7,000-m-thick, predominantly volcanic Nsuze Group of the Pongola Supergroup of southern Africa. The Nsuze Group comprises:

- volcaniclastites, including air-fall tuffs, up to 120 m thick, composed of lithic and crystal fragments in a fine matrix of volcanic ash and dust;
- welded ash-flows (10 m thick) deposited by flowage of a turbulent mixture of gas and pyroclastic material;
- agglomerates comprising heterolithic, rounded-to-ellipsoidal clasts representing magma clots ejected during explosive eruptions;
- and volcanogenic sediments composed of reworked pyroclastic deposits.

Fairer describes the Hulayfah Group of Saudi Arabia, which he noted

> "… is composed of metasedimentary and metavolcanic rocks that are the product of subsea eruptions, rapid transport and deposition of volcanic debris by turbidity currents, and subaerial explosive eruptions and deposition of ash-flow and ash-fall tuff. Rocks in the western part … tend to be massive to thick-bedded and coarse-grained agglomerates, volcanic flows, and tuffaceous rocks."[35]

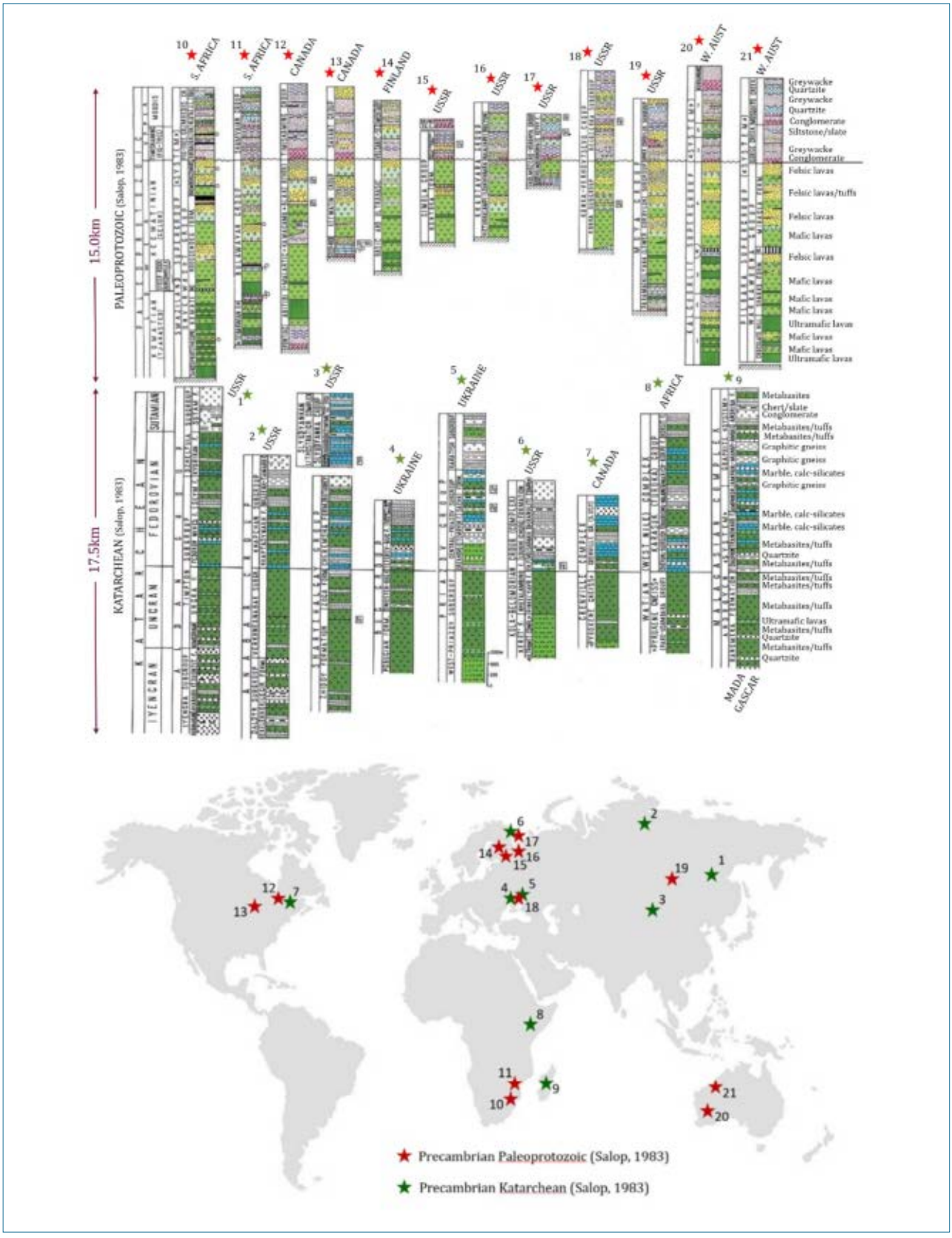
Thurston noted the occurrence of subaerial volcanism in the *Uchi subprovince* of the Canadian Shield, where there are "three major cycles of mafic to felsic metavolcanic rocks forming a section 8,500–11,240 m thick".[36] Cycle 2 comprises 1,600 m of pillowed and massive mafic lavas, overlain by 1,000 m of intermediate subaqueous ash flows, and up to 540m of felsic tuff, lapilli tuff, lapillistone, and tuff breccia. Felsic metavolcanic rocks of the *Woman Lake Tuff*, with a volume of 63 km^3, comprise the uppermost 100–150 m of Cycle 2 and include air-fall tuffs, lapilli tuffs, tuff breccias, crystal lithic air-fall tuffs with pumice, and lithic clasts in an ash matrix.

Potgieter and Visser documented various products of explosive volcanism in the Precambrian Ventersdorp Group of the Northern Cape province, South Africa, and wrote as follows:

> "Rhyolitic vitric and lithic tuffs, accretionary lapilli-tuff, volcaniclastic sandstone and tuffaceous siltstone and shale attain a thickness of about 40 m."[37]

> "Ash-flows giving rise to ignimbrites built the largest part of the succession, while ash-falls and reworked volcanic material are subordinate. The volcanism was of an explosive nature with the centre of eruption located near-by to the southwest. The acid volcanism was followed by a lengthy period of erosion before the outflow of the andesitic lava of the Ventersdorp Group."[37]

> "The fractured crystals, lapilli, the general phenoclastic texture of the ignimbrites, and the absence of pumice



Lithostratigraphic columns reprinted by permission from Springer Nature: *Geological Evolution of the Earth During the Precambrian*, Salop, L.J., 1983.

Figure 4. Lithostratigraphic columns of Salop[13] (above) and locations of lithostratigraphic columns (below)

Figure 5. Lava fountain of Mt Etna showing lava, pyroclastic fragments, and atmospheric tephra plume

point to the explosive nature of the volcanism. A possible gas phase, which separated during the ascent of the magma to the surface, may have led to a sharp increase in the viscosity resulting in an explosive eruption."[38]

Papezik described the 1,500-m-thick Harbour Main Group of Newfoundland:

"The predominantly volcanic *Harbour Main Group* of Late Precambrian age … includes some well-developed ignimbrites. The ignimbrite sequence, … consists of ash-flow tuffs intercalated with tuff–breccias of various origins and minor volcanigenic sediments [emphasis added]."[39]

Falkum[40] described a deformed agglomerate in the Precambrian of southern Norway.

Torske[41] described a 2,000-m-thick metavolcanic and metasedimentary sequence comprising basaltic lavas, tuffs, volcanic breccias, agglomerates, and bedded tuffs in the Precambrian of southern Norway.

Hickman and Van Kranendonk[42] examined the lower *Pilbara Supergroup* in the East Pilbara granite-greenstone terrane of northern Western Australia. After detailed geological mapping[43] did not reveal any thickening of the Supergroup, due to stratigraphic repetitions by thrust faulting or recumbent folding, they concluded that the lower Pilbara Supergroup was constructed through the accumulation of eight repeated 'ultramafic to mafic to felsic cycles' (figure 6) which they suggested were "consistent with derivation from eight successive mantle plume events". These eight 'ultramafic to mafic to felsic cycles' vary in thickness from 1.00km to 5.85km, and make up an aggregate thickness of the lower *Pilbara Supergroup* volcanic pile of 21.85 km.

Global correlation of the Precambrian

In the mid-1960s, many workers in the Precambrian recognized similarities in early Precambrian sequences in various parts of the globe. Glikson noted as follows regarding early Precambrian strata:

"Independent investigations of the early Precambrian systems of Western Australia, South Africa, and Canada by many workers, are leading to remarkably similar observations, implying *a world-wide uniformity of the Archaean series with respect to their stratigraphy, petrology, and geochemistry* [emphasis added]."[44]

The recognition of similarities in early Precambrian sequences throughout the globe led ultimately to global correlations of these early Precambrian strata sequences. Probably the clearest illustration of the globally correlative nature of the early Precambrian rock record is that presented in 1983 by Soviet Geologist Professor Lazarus J. Salop, then of the All-Union Geological Research Institute, Leningrad, USSR. In his book *Geological Evolution of the Earth During the Precambrian*,[13] Salop presented 75 lithostratigraphic columns of Precambrian sequences from all continents (figure 4). These columns show that, based on the superpositional relationships of distinct lithological associations, the Precambrian can be globally correlated. This global correlation is especially apparent in Salop's Paleoprotozoic compilation, and apparent to a lesser degree in his Katarchean compilation (figure 4).

Having ruled out paleontological methods and radiometric dating as valid methods of correlating Precambrian strata, Salop used what he called the 'geohistorical … methods'[45] to subdivide and correlate Precambrian sequences throughout the globe. The 'geohistorical method', Salop explains, involves the accumulation and interpretation of factual or 'empirical' geological data to elucidate recurrent 'empiric regularities'[50] in the Precambrian geologic record. Salop suggests that Precambrian subdivision

"… can be established on the basis of specific types of formations or on larger tectonic elements

(structures) typical of *definite stages of geologic evolution* [emphasis added]."[46]

Salop recognized that

"… certain irreversible changes in the tectonic evolution of the earth exist, and … are … also known in the chemical composition and thermodynamic conditions of its outer shells which, … govern the evolution of sedimentation and rock formation. The origin of specific, unique types of rocks and their associations … is a result of this evolution and they build up definite levels in the normal Precambrian sequence and thus can be used for the global correlation [emphasis added]."[45]

In a review of Salop's book, Prof. A.M. Goodwin described Salop's work as "a succinct statement on Earth's evolution during the Precambrian",[47] noting that

"The main contribution of the book lies in the description and interpretation of 75 key lithostratigraphic sections as a basis for the recognition of *natural stages in the evolution of Precambrian continental crust* [emphasis added]."[47]

When the Precambrian geologic record is viewed in its global context, as it is, for example, in Salop's correlation of the lithostratigraphic complexes of the Paleoprotozoic and Katarchean (figure 4), the early Precambrian is seen to be globally correlative.

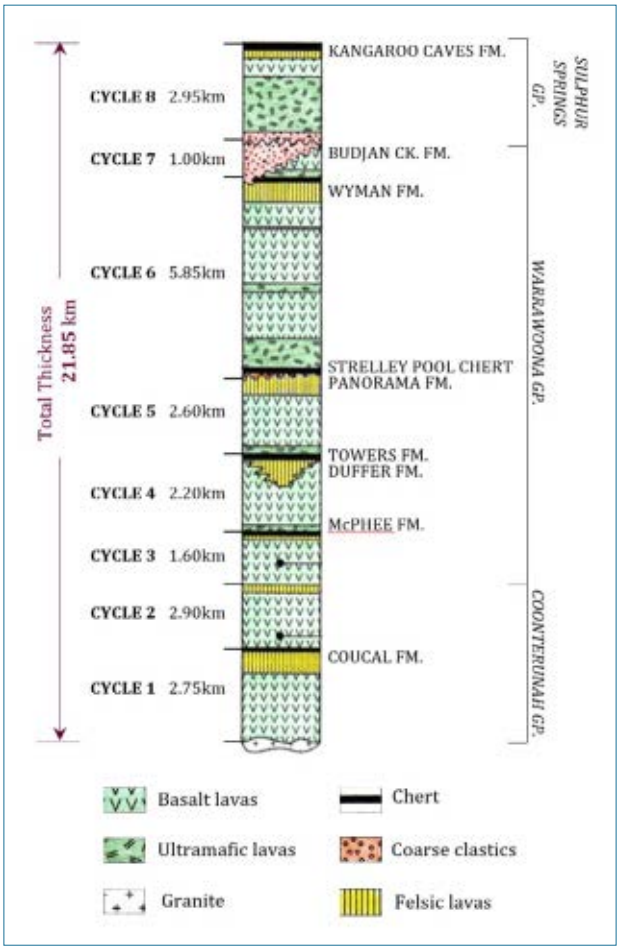


Figure 6. Lower Pilbara Supergroup Western Australia showing eight ultramafic to mafic to felsic lava flow cycles varying in thickness from 1.00 km to 5.85 km for an aggregate thickness of 21.85 km (after Hickman and Van Kranendonk[42]).

A gravitational decompression–recompression Genesis Flood geologic model

In Hunter,[48,49] I proposed a gravitational decompression–recompression Genesis Flood geologic model (figure 7) which is based on the following two reasonable assumptions:

1. If God created gravitational force, He would be able to change it, either temporarily or permanently, whenever and by whatever means He chose, and
2. The Earth's created mantle was just below its melting temperature at the created pressure, and water saturated.

On Day 1 of the Flood cataclysm, the hot, water-saturated created mantle was decompressed due to a reduction of gravitational force, perhaps consequent upon a temporary increase, by God, in the value of the r-exponent of the Universal Gravitational Law ($F = G.(m_1.m_2)/r^2$). An increase in the value of the r-exponent would cause an exponential decrease in gravitational force with consequent decompression of the earth's mantle. Decompression of the created hot, water-saturated mantle caused it to melt and differentiate, extruding magmas, lavas, all the components of the Precambrian volcano-sedimentary record, and copious water (the "fountains of the great deep" Gen. 7:11). Decompression also caused the atmosphere to differentiate outwards, away from the earth's surface.

On Day 40, gravitational force was partially restored, and consequent recompression caused partial solidification of the mantle, and consequent reduction of extrusive activity, without the need to remove any heat. The late Precambrian *Ediacaran Biota* and the basal Cambrian *Cambrian Explosion* fossil assemblages were dumped out of the floodwaters due to a sudden reduction of buoyancy.

During the period Day 40 to Day 150, the Phanerozoic geologic record was deposited, mostly in the intershield areas (figure 1). This probably occurred partly by limited continued extrusion of material from the mantle and partly by erosion, transport, and deposition of previously extruded Precambrian material.

On Day 150, complete solidification of the mantle, with consequent complete cessation of mantle extrusive activity, was achieved by complete restoration of gravitational force, possibly by restoration of the r-exponent to its created value of two. This occurred without the need to remove any heat. Recompression caused the newly formed ocean basins to sink, and the floodwaters began to flow off the land into the

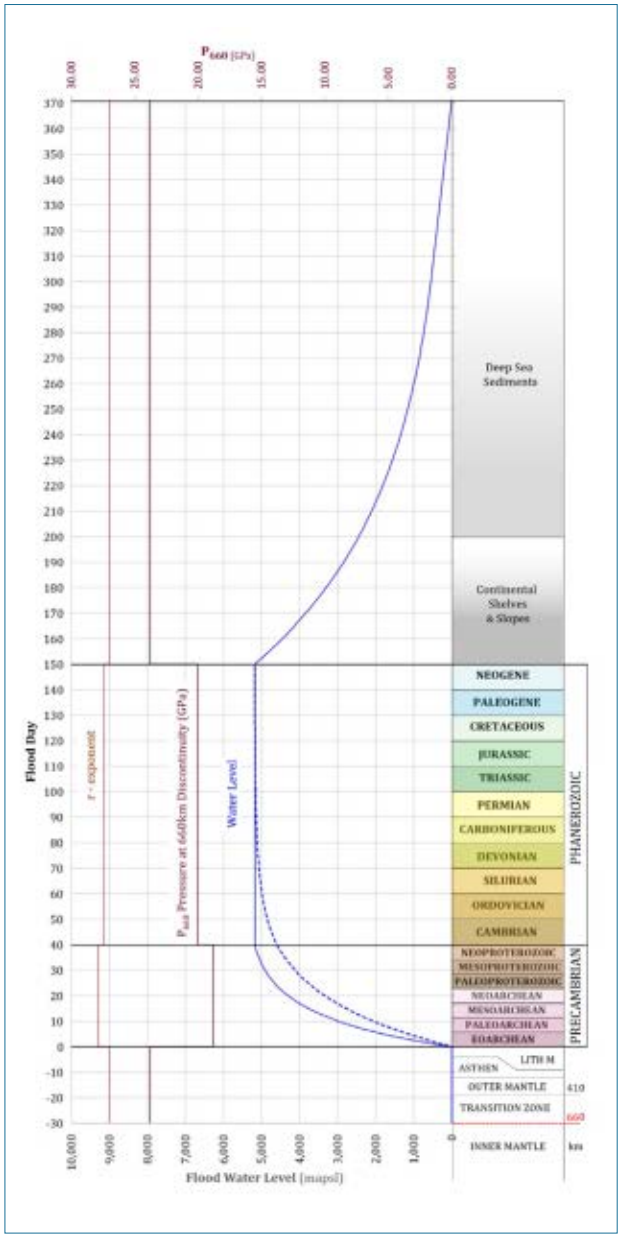


Figure 7. A gravitational decompression—recompression Genesis Flood geologic model. It shows the variation of floodwater level, the r-exponent of Universal Gravitational Law ($F = G.(m_1.m_2)/r^2$), the pressure at the 660 km discontinuity in the earth's mantle (P_{660}) during the Flood, the Precambrian and Phanerozoic geologic records, the continental shelves and slopes, and the deep sea sediments. Blue dotted line is the water level if water extrusion from mantle was not completely stopped on Day 40.

ocean basins from Day 150 to Day 371, depositing first the continental shelves and slopes, and later the deep ocean floor sediments. Recompression caused the global atmosphere to re-equilibrate, back towards the earth's surface, causing the 'wind', which God made "to pass over the earth" (Gen. 8:1) coincidently when the floodwaters began to subside.

The Precambrian fossil record

Much of the earliest Precambrian fossil record comprises prokaryotic microbial organisms, which first appear at c. 3,680 Ma,[50] and increase in complexity and size up-sequence through the Precambrian. Multi-celled eukaryotic fossils appear at c. 1,970 Ma, and finally, very near the top of the Precambrian at c. 565 Ma, the Ediacaran Biota fossil assemblage, comprising macroscopic complex soft-bodied organisms, including some of the earliest animals, appears.

The Cambrian Explosion fossil assemblage, comprising most major groups of complex animals, occurs at the base of the Cambrian at c. 542 Ma, perhaps close enough to the late Precambrian Ediacaran Biota assemblage at c. 565 Ma that, in a Genesis Flood model, both can be considered as being due to the same cause. The paucity of evolutionary predecessors to the Ediacaran Biota and Cambrian Explosion assemblages, and the sudden appearance in the fossil record of these complex animal fossils, was labelled 'Darwin's Dilemma'.

Secular researchers interpret the increasing complexity of fossilized organisms up-sequence through the Precambrian as a record of evolution. Some suggest that the evolutionary progression may have been significantly influenced by environmental conditions in the Precambrian oceans. Knauth, for instance, notes: "the possibility that high temperature and salinity were major factors affecting microbial evolution", and "As first noted by Hoyle, the fossil record suggests that organisms appeared on Earth sequentially in order of tolerance to high temperatures."[51] Schopf notes, regarding microbial fossil fragments found in the Precambrian *Apex Chert* in Western Australia:

> "The Apex fossils are scrappy. Hard to find. Difficult to study. They are abundant but *charred, shredded, overly cooked* [emphasis added]."[52]

Some creationists have suggested that the distribution of fossils in the Precambrian record may have been significantly influenced by environmental conditions associated with the Genesis Flood cataclysm. Oard, for instance, notes the paucity of body fossils in the Neoproterozoic and asks: "*could the lack of preservation be due to the violence of the Flood mechanism?* [emphasis added]."[53]

During extrusion of the hot Precambrian lavas, many of which were extruded subaqueously, multi-celled soft-bodied organisms living in intershield areas (figure 1) escaped immediate destruction by the extruding hot Precambrian lavas. Similar organisms living in the cratonic areas were protected from immediate destruction by riding high in the upwelling floodwaters due to their buoyancy, with some being washed away to be fossilized in the Phanerozoic strata in the intercratonic areas. Those that remained in the floodwater column were dumped out of the floodwaters to form the multi-celled 'animal' fossil assemblages of the late Precambrian Ediacaran Biota and the basal Cambrian

Cambrian Explosion Biota on or about Day 40, when partial restoration of gravitational force severely restricted mantle extrusion, with a resultant sudden loss of buoyancy. Darwin's Dilemma is thus explained.

The distribution of fossilized organisms throughout the Precambrian was influenced by their morphology and by progressively moderating organism-destructive conditions, including volcanism, high temperatures, corrosion, turbulence, and attrition in the rising floodwaters during the period Day 1 to Day 40.

Some creationists[54] suggest that Precambrian strata, containing fossilized organisms, may have formed during Creation Week. Fossilization of these organisms, they argue, need not have involved death before the Fall, because they were not *nephesh* life. The real issue here, however, I suggest, is not *life* vs *non-life* but rather *functionality* vs *destruction*. Regardless of their 'life vs non-life' status in the created order, all organisms fossilized in the Precambrian were destroyed; i.e. the Flood rendered them incapable of performing the purpose for which they were created.

Discussion and conclusions

In Genesis 1:1 it is recorded that on Day 1 of Creation Week, God created "the heavens and the earth" (*'eretz*). Then, in Genesis 6:13, we read that before the Flood, regarding "all flesh", God said to Noah, "I will destroy them with the earth" (*'eretz*). Then, in Genesis 9:11, after the Flood, God confirmed to Noah that by the Flood He had indeed destroyed the created Earth, when He said, "never again shall there be a flood to destroy the earth" (*'eretz*). Whatever constituted the *'eretz* that was created on Day 1, God destroyed it by the Flood cataclysm.

Corroborating God's revelation to Noah that the created Earth (*'eretz*) had been destroyed in the Flood (Gen. 9:11) is the record of widespread destructive volcanic and sedimentary processes evident in the Precambrian rock record. In the Precambrian we see evidence of huge volcanoes, depositing lava accumulations up to 22 km thick, including abundant products of explosive volcanic activity.

Walker noted that the Precambrian Strelley Pool Chert formation in the Pilbara region of Western Australia (figure 6) is underlain and overlain by rocks deposited from volcanic eruptions, and suggested:

> "From a biblical perspective*, it is inconceivable that volcanoes would be active during Creation Week, depositing volcaniclastics and tuff such as comprise parts of the stratigraphic sections* [emphasis added]."[55]

Widespread evidence throughout the globally correlated Precambrian rock record of huge explosive volcanic eruptions comprises tuffs, ignimbrites, pyroclastic flows, volcaniclastics, accretionary lapilli/lapillistone, and agglomerates. The processes necessary for the accumulation of accretionary lapilli/lapillistone include an atmospheric ash column, moisture, accretion, deposition, and lithification. We might reasonably question whether atmospheric ash columns would have been occurring during Creation Week.

Deposition of even the thinnest of these volcanic accumulations, the 10.5-km-thick Swaziland Supergroup (figure 3), over six days during Creation Week, would require lava to accumulate at 1.75 km stratigraphic thickness per day. The 22.0 km-thick-lower Pilbara Supergroup of Western Australia (figure 6) would need to accumulate at 3.67 km of lava per day if deposited during Creation Week.

On the basis of the volcanic content, and especially the explosive volcanic content, and the widespread destruction of organisms throughout the Precambrian, we should, I suggest, question a Creation Week or Antediluvian origin for the Precambrian rock record, reconsider the way we interpret the Precambrian fossil record, and conclude that the Precambrian is all Flood deposited.

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Was Darwin's end goal to 'murder' God?

Jerry Bergman

Darwin made it very clear that his goal for developing his theory of evolution by natural selection was to devise another 'creator' to account for the existence of life, namely evolution. This was documented in his 1844 letter to Joseph Hooker.[1] This goal of Darwin created a nearly life-long conflict with his conscience, which began when he first devised his naturalistic evolutionary theory. The data shows that, in the minds of many scientists and academics, Darwin successfully murdered belief in God. Evidence from his writing and life suggest that this was at least his unconscious (and possibly his conscious) goal, though he never openly acknowledged it. There were many good reasons for him not doing so; had he proclaimed such a goal, it would have been enormously counterproductive to his work. Moreover, his wife and many of his friends were Christians.

It's like confessing a murder

In a letter to Joseph Hooker (figure 1), dated 11 January 1844, Darwin (figure 2) wrote, in contrast to his original belief, that he now believed "species are not immutable (it's like confessing a murder)."[1] In a *Scientific American* paper titled "Darwin on a Godless Creation: 'It's like confessing to a murder'", Marty explained in detail the background of Darwin's statement:

> "Before marriage, Charles Darwin had confessed everything to her [Emma]. That he was in the process of rewriting the history of life. That, according to his convictions, all living things descended from a common ancestor. And that species were not to be attributed to God's endless creativity, but were the product of a blind, mechanical process that altered them over the course of millions of years."[2]

His conviction that humans are the product of a blind, mechanical process over millions of years supports what is argued here. Namely, that Darwin's goal (either unconsciously or possibly at some level consciously), in developing his theory of evolution by natural selection was to 'murder' God by replacing Him with another 'creator' to account for life's existence. Darwin knew that the main reason people believed in God in his day (and in ours as well) was the fact that evidence of creation requires a creator. Linked to this was the common belief in his day that species never change (although even some creationists at the time believed they could vary, within clear limits). Darwin acknowledged that even just admitting to having departed from the belief that species were fixed was like confessing a murder.[3] If Darwin could come up with another theory that satisfactorily explained at least the origin of the biological creation, he realized that the main reason people gave for believing in God would no longer exist. This would result in many giving up belief in God, which history has confirmed is exactly what has happened.[4] As evolutionist Michod puts it:

> "Before Darwin, people of the Judeo-Christian or Moslem traditions had assumed that living things must have been created by a being such as God. Darwin showed that the creator of all living things was, in fact, not a divine being who stood apart from life, but a *process* intrinsic to life—natural selection. Ultimately, this process provides the rationale for our existence, and it is in this process that we must seek an explanation of our basic nature, the origin of our needs and desires, and the process of sex."[5]

Darwin's theorizing affects his health

The theory Darwin developed, which ended up displacing God in the minds of many, was evolution by natural selection. However, Darwin himself had doubts about its ability to account for all of creation, and this had a critical effect on his health. The 'murder-caused-guilt' hypothesis can account for many of Darwin's frequent debilitating health problems, which were mostly psychological, and possibly due to Darwin's conflicts about his goals for (or at least the outworkings of) evolution.[6] An analysis by Freud's disciple, Alfred Ernest Jones, from a study of Darwin, compared

> "… the reactions of the two men who discovered the relation of Natural Selection to Evolution, which meant displacing God from His position as … . Creator specially concerned with mankind, and removing Him to an infinitely remote distance … Darwin, the one who stood in such awe of his own father, said it was 'like committing [*sic*] murder'—as, indeed, it was unconsciously … . He [Darwin] paid the penalty in a crippling and lifelong neurosis, and in an astonishing

Figure 1. Joseph Dalton Hooker

> display of modesty, hesitancy, and dubiety concerning his work. The other, A.R. Wallace, compensated for the displacement of the supernatural by bringing it back in another sphere, by his quite naïve adherence to spiritistic beliefs."[7]

Colp summarized Jones's conclusion by noting that, by 'murder' Darwin "meant 'parricide', the murder of God the father."[8] One of the world's leading Darwin scholars, Michael Ruse, agreed with Jones, writing that

> "Darwin knew his theory was much better than Chamber's [rival theory] … but it was evolutionary and materialistic nonetheless … . When telling Hooker of his evolutionism, Darwin confessed that it was like admitting to a murder … . It was a murder … of Christianity, and Darwin was not keen to be cast in this role. Hence the *Essay* [which became the *Origin of Species* finally published in 1959] went unpublished."[9]

Colp also features the word 'murder' in a different context, though still related to the discussion of the implications of Darwin's theories. He refers to Darwin's

> "… moral feelings about his theory of evolution: evolution operates, not by the morally tolerable Lamarckian mechanism of 'slow willing', but by the morally intolerable mechanism of 'murder'. 'Murder', the massive murder of all unfit, aptly describes and characterizes the War of Nature."[10]

Colp further observed that Darwin realized "his theory would be viewed with opprobrium equivalent to that attached to murder and that he would receive a punishment equal in severity to that given to a murderer," and for "the murder of God, of Christianity … . Darwin must have believed that it was honest, manly, and courageous to confess what he really believed and to face his punishment."[11] Indeed, Darwin received as punishment a lifetime of illness.

Darwin's success in adversely influencing Christianity

Darwin's theory has 'remade the world', converting the West from the Christian world to the post-Christian world.[12] MIT Fellow Angela Saini wrote this about the Genesis creation account, concerning which

> "… the naturalist and biologist Charles Darwin published *The Descent of Man*, sweeping away these religious creation myths and framing the human species as having one common ancestor many millennia ago and as having evolved slowly like all other life on earth."[13]

In only a few years, Darwinism both took over the world of academia and became the dominant view of the educated members of Western society. In short, Darwinism is considered "the single most important idea of the nineteenth century. It is also an account of issues and concerns that are still very much with us, including … the enduring conflict between science and religion."[14]

Many leading scientists have been very clear that their open opposition to Christianity is based on their belief in evolution. One example was related by Oxford Professor emeritus Richard Dawkins. Dawkins related a 1996 meeting with his friend, Nobel Laureate James Watson, the founding genius of the Human Genome Project, for a BBC television documentary that Watson was then involved in. Dawkins asked Watson, a former Catholic until he learned about evolution

> "… whether he knew many religious scientists today. He [Watson] replied: 'Virtually none. Occasionally I meet them, and I'm a bit embarrassed [laughs] because, you know, I can't believe anyone [today] accepts truth by revelation.'"[15]

Another example occurred at a recent conference held at New York's City College when a member of the audience

> "… asked a panel of Nobel laureates whether a true scientist could also believe in God. Chemist Herbert Hauptman answered with a definitive 'No!'—reasoning

that quality science and supernatural beliefs are irreconcilable, and adding that such beliefs are 'damaging to the well-being of the human race'."[16]

Anecdotal examples such as those noted above are useful, but limited. Furthermore, the religion of scientism teaches that no "immaterial and supernatural forces exist."[17] It is believed that only the material world exists, nothing else. The incompatibility of theism and evolution is evident from the huge disparity in beliefs between scientists and laypeople.

"While only 6% of the American public describe themselves as atheists or agnostics, 64% of scientists at 'elite' American universities fall into these classes … . This figure is much higher for more accomplished scientists. A survey by Larson and Witham (1998) showed that 93% of members of the National Academy of Sciences, America's most elite body of scientists, are agnostics or atheists, with just 7% believing in a personal God. This is almost the exact reverse of figures for the American public as a whole."[18]

The survey by Larson and Witham is one of many studies that attempted to show scientists in the most favourable light possible, yet still documented the large religious faith dichotomy between the average American and leading scientists. Before Darwin, few exceptions existed to the conclusion that virtually all scientists were theists and creationists; after him, the situation has reversed, and very few now identify as theists, far less still as creationists.[19]

A former ministry student, now an atheist after he learned about evolution, Michael Shermer wrote:

"On January 14, 1844, Charles Darwin wrote a letter to his friend Joseph Hooker, recalling his voyage around the world on the HMS *Beagle*. After five years at sea and seven years at home thinking about the origin of species, Darwin came to this conclusion: 'At last gleams of light have come, & I am almost convinced (quite contrary to the opinion I started with) that species are not (it is like confessing a murder) immutable.'

Like confessing a murder. Dramatic words. But it doesn't take a rocket scientist—or an English naturalist—to understand why a theory on the origin of species by means of natural selection would be so controversial. If new species are created naturally—not supernaturally—what place, then, for God? [emphases in original]"[20]

Darwin knew he was murdering God, a conclusion that doesn't take a rocket scientist to come to. LaGard Smith also accepted this view, adding that God is dead in the minds of most eminent scientists.[21] Smith also said that

"… by definition from Darwin on down evolution

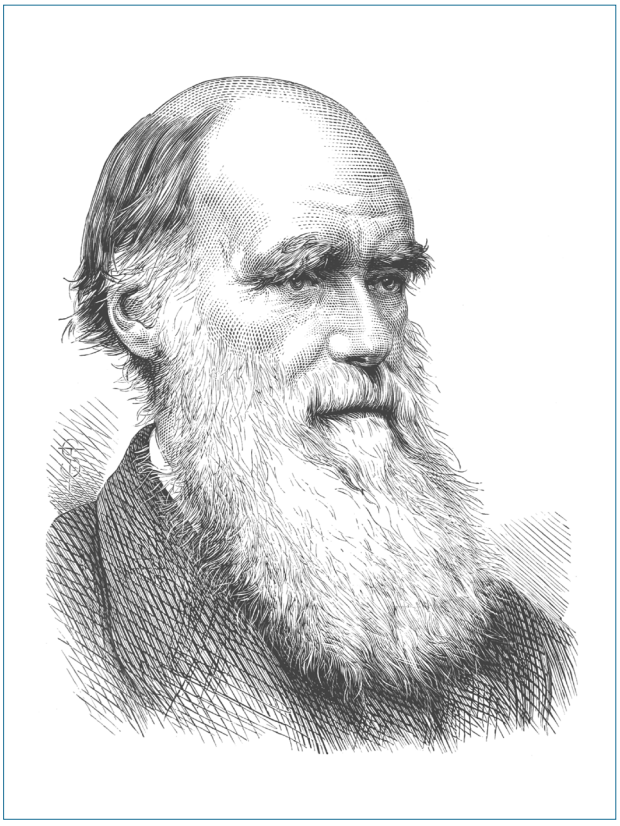

Figure 1. Charles Darwin

is a wholly *natural* process without some purposeful intelligence [such as God] involved at any point from microbe to man, it is misleading, disingenuous, and unworthy of intelligence to use the term 'evolution' when contending that in some supernatural way God was in control of the enterprise [emphases in original]."[22]

In one of the definitive biographies of Darwin, Brent wrote Darwin's vision of nature was

"… founded upon old-fashionably mechanistic and materialistic beliefs … showed nature running without the necessity of guidance or intervention … organized by logic and proceeding by its own energies, that led to his years of devotion to it his theory, and to his stubbornly reiterated defense of its principles. He resented when great scientists like Herschel wrote that 'an intelligence, guided by purpose, must be continually in action to bias the direction of the steps of change', since it was precisely the *elimination* of that hypothetical intelligence [God] that seemed to him his greatest triumph [emphasis added]."[23]

Michael Ruse writes that the results of Darwin's murder was a revolution in the 19th century and

"… naturalist Charles Darwin was at the heart of

it. However, contrary also to what many think, this revolution was not primarily scientific as such but more religious or metaphysical, as people were taken from the secure world of the Christian faith into a darker, more hostile world of evolutionism."[24]

Conclusions

Professor Hopper opined that the Darwinian establishment conversion to the idea that evolution was the creator, not God, changed the world by negating the reason most people believe in God.[25] The results are clear: large numbers of scientists are either agnostics or atheists, and the vast majority of the most elite scientists in the West are atheists. Destroying the evidence for God as the creator was, in Darwin's words, like confessing a murder, namely the murder of God. I agree with Darwin's wife, Emma, who correctly diagnosed her husband's health problems as being "always affected by his mind".[26] This knowledge of what his life's work was in effect doing to belief in God naturally produced enormous internal conflicts in Darwin's mind. This resulted in a major toll on his health until he died, diagnosed today, from his symptoms, as congestive heart failure at age 73.[28]

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Is the outer ear (the pinna) useless as Darwin believed? Its function revisited

Jerry Bergman

Darwin claimed that the pinna in humans served no function and he believed it was inherited from our putative ape ancestors. Research has documented that this claim is misleading. It actually has several functions, including to help determine the source of sounds and as a means of communication to other persons.

One of the most noticeable features of the human face is the external, visible part of the ear, called the pinna or the auricle (figure 1).[1] This outer ear consists primarily of elastic cartilage covered with skin. It is a critical organ that, in animals, can be moved to more accurately locate the source of sound and improve its reception, and also aid communication between conspecifics.[2] Darwin observed this fact and noted that humans could not move the pinna as can many animals. He opined the ear muscles in man are so degenerate that the ear cannot normally be moved.[3] For several reasons he wrote much about the pinna and what he concluded was its lack of function in modern humans.[4] Science journalist Rosie Mestel writes about Darwin's curt response to the pinna's function: "With a flick of his quill pen, Darwin shrugged off the pinna in *the Descent of Man*" as useless.[5] One reason Darwin gave for claiming the pinna lacked a function was "a study of a sailor who'd had one pinna cut off in a scuffle but could still hear just as well with that ear."[6]

Darwin believed that humans evolved from some unspecified lower-level primate that could move its pinna to direct sound waves into the ear canal.[7] As university Professor Robert Butler noted, Darwin argued "that our pinnae are small and we can't move them about as many animals can … our pinnae may have had a function earlier on in our evolution, but now they're [useless] vestiges."[6]

Some of Darwin's correspondents supported his conclusion that the human outer ear lacks a function. One example is Jena University Professor William Preyer, who concluded that the external ear has no physiological functions, only a decorative role. He wrote to Darwin:

> "I shall also, I hope soon, have the pleasure of sending you a paper on the physiological functions of the external ear, wh[ich] are nearly naught, contrary to what many physiologists believe. This result is in accordance with your remarks on the rudimentary nature of the concha. But how is it to be explained that only the human ear has an ear-lap? And the ears of the negroes have none."[8]

Darwin answered in a letter dated 30 April 1871 as follows:

> "I shall be particularly glad to see your paper on the external ear, as this will be very useful for any future corrected edition of my book. I was quite unaware of the inexplicable fact of the deficient ear-lap in negroes."[9]

After Darwin, the vestigial claim for the pinna was often uncritically repeated. A typical example is the claim by Rogers *et al*. that the outer

> "… ear is another part of the body that shows numerous vestigial features. The entire *outer ear* is so greatly reduced in size and so ineffective as a funnel for concentrating sound waves, compared to its development in many of the lower mammals, that it must itself be regarded as a vestigial organ."[10]

Since humans normally cannot move the pinna, as can many animals, Darwin considered it a functionless evolutionary remnant of a much larger functional pinna that our putative evolutionary ancestors possessed. Furthermore, Darwin claimed that the "whole external shell of the ear may be considered a rudiment, together with the various folds and prominences (helix and anti-helix, tragus, and anti-tragus)."[3] Historically,

> "… the shape of the external ear has attracted Man's attention from remote ages. In the traditional lore of Indo-China an ear with a long lobe is held to be a sign of great wisdom. Aristotle considered long ears indicated an outstanding memory. Darwin referred to the human ear as a rudimentary organ."[11]

In many societies older people were believed to have greater wisdom, and at least it appeared that they typically had longer, or larger, ears as well, possibly because aging affects the facial proportions.[12] This may be the source of this lore.

Claims that the pinna has no function disproved

The first problem with the notion of the pinna's vestigial nature is that Darwin's claim that one can hear just as well without it is not supported by research.[13] One summary of the research related that "the Taliban punished a group of Afghan truck drivers suspected of collaborating with U.S.-led troops by chopping off their ears."[14] In answer to the question of whether loss of the pinnae would affect their hearing, Baylor College of Medicine professor Dr John Oghalai and Advanced Ear, Nose & Throat Specialist Dr Madan Kandula indicated that it *would definitely* affect their hearing:

Figure 1. Adult human outer ear

> "The outer part of your ear, known as the pinna, funnels sound into your ear canal, like a megaphone in reverse. If someone cut it off, everything would sound quieter. (A wound that scabbed over would make the sound suppression more severe.) The pinnae also tell you where sounds are coming from: The ridges and grooves shape sound waves differently depending on where the sound originates. As a result, the brain learns to associate certain amplification patterns with certain directions. So, if you lost your ears, you might be able to tell what music you're hearing, but not where the speakers are."[14]

Research has supported this clinical observation,[15] noting that the pinna is required for both effective sound amplification and localization.[16]

Children born without pinnae—a deformity called microtia—have been studied in some detail. Such a deformity

> "… is a congenital anomaly, characterized by a small, abnormally shaped auricle (pinna). … The estimated prevalence of microtia is 0.8–4.2 per 10,000 births, and it is more common in men. Microtia can have a genetic or environmental predisposition. Mendelian hereditary forms of microtia with an autosomal dominant or recessive mode of inheritance, and some forms due to chromosomal aberrations have been reported. Several responsible genes have been identified, most of them being homeobox genes."[17]

The problems, such as social and communication issues, that result usually prompt an attempt to reconstruct the pinnae, not only for the sake of appearance, but also to improve hearing. Building a new pinna is a very complicated task; surgeons graft a section of cartilage from the ribs, carve it into the pinna shape, then implant it under the skin where the pinna would be. Then a skin graft is used to make the fake ear protrude. The process requires three or four operations, and can take up to two years to complete.

New research shows the pinna responds to sound direction

A recent study concluded that we make small movements of the pinna, which, the authors hypothesize, facilitates better hearing and improved sound localization. They write:

> "Many animals … move their ears to better focus their attention on a novel sound. That humans also have this capability was not known until now. A research team based in Saarland has demonstrated for the first time that we make minute, unconscious movements of our ears that are directed towards the sound we want to focus our attention on."[18]

The researchers recorded signals that control the minute movements of the pinna by surface electromyography (EMG). Sensors on the subject's skin detect electrical activity produced by the muscles that move the pinna or alter its shape.[19] To assess reflexive, stimulus-driven attention, the researchers presented novel sounds from speakers at four different lateral locations while participants silently read a text to distract them. To test voluntary, goal-directed attention, participants listened to a story coming from one of the speakers, while ignoring a competing story from the speaker on the opposite side. The fact that the neural networks function to slightly move the pinna indicates the pinna system does have a function which may improve hearing quality, especially directional hearing. The study concluded "that the direction of auditory attention is reflected in sustained electrical activity of muscles within the [claimed] vestigial auriculomotor system."[19]

These tiny movements appear to be part of a sensory system that triggers the gross muscle system to move the head toward the source of the sound of interest.[20] Another function is to improve the function of the pinna's role to amplify certain sounds, especially those sounds used to communicate with others. The best example of this effect is when a lecture in a classroom is recorded one notices it picks up many unwanted sounds, such as the ventilation system noise that those in the room are often not aware of. The reason is our hearing system is effective in reducing, or even eliminating, sounds outside of the normal human communication range, which is from 300 to 4,000 Hz. Conversely, most healthy humans can hear a range from 20 to 20,000 Hz. The finding also has possible clinical applications. For example:

> "These tiny movements could be used to develop

better hearing aids that sense the electrical activity in the ear muscles and amplify sounds the person is trying to focus on, while minimizing other sounds."[19]

Could these muscles be developed so that they have a small role in moving the pinna which may not be important in everyday life, but could be significant in certain occupations, such as a musician? As with other talents, the degree of their development depends on the genetics, interest, and the hours of practice of the person, a fact that could be part of the use and development of this muscle system. Are there persons that have developed this system to the degree that it aids their hearing? After all, we know the small internal and external grooves in the pinna play a significant role in amplifying the sounds of concern in hearing.[21] It may not take a very large movement to be of benefit in enhancing the effect. Perhaps the most important explanation for the purpose of the muscles that slightly move the ear is that they are intended to function as part of the total set of face musculature (43 face muscles plus the eight temporal and extrinsic human ear muscles), which set plays an important role in conveying a variety of emotions so important to effective human-to-human interactions.[22]

Lastly, an important role of the pinna is to pick up information about the details of the sound source, which then must be processed by the brain.[23] Specifically, sound localization, which is especially important in humans, is processed by a complex network including anterior and posterior regions of the temporal lobe, the posterior parietal cortex, the dorsolateral prefrontal cortex and the inferior frontal cortex.[24] And the design of the pinna is critical in obtaining the information required to accurately pinpoint the source of sound information, both in humans and other mammals.[25] Some of the research on sound location is on animals because the same research on humans would be unethical.

Conclusions

In conclusion, research has shown that, in contrast to Darwin's claim, the external ear is a well-designed structure that effectively collects and amplifies sound in the frequency ranges most important to humans for communication, which is from 300 to 4,000 Hz.

Furthermore, the slight muscle-induced movement of the ear, while it has little effect on moving the pinna, may be part of the sensory system, which facilitates the person moving their head toward the sound source. This is one reason that determining direction, detection, and sound localization in humans is so effective. Even if such slight ear movements are largely non-functional for hearing, it is still functional as an incidental effect of the role of the total musculature involved in the important role of emotional social interaction.

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The origin of L-amino acid enantiomeric excess: part 1—by preferential photo-destruction using circularly polarized light?

Royal Truman

A hypothetical astronomical source of UV right-circularly polarized light (r-CPL) is the favoured evolutionary theory for the origin of homochiral amino acids. Astronomers have not been able to find polarized UV light anywhere in the relevant region of space, however. Furthermore, the c. 1% enantiomeric excess (*ee*) claimed for some amino acids based on optimized synchrotron experiments is misleading. 99.99% to 99.999% photo-destruction of racemic D- and L-amino acid (AA) mixtures would be necessary, using *specific wavelengths* (λ) to capitalize on minute differences in D and L absorption. Realistically, however, a minute excess of the surviving enantiomer would have been sometimes positive and other times negative over a range of absorbing λ, tending to cancel out any preference. Realistically, the hypothetical destructive r-CPL absorption would have occurred over a wide range of wavelengths, producing far lower than 1% ee_L even after >99.99% photo-destruction. Upon arriving in trace concentrations on a putative still hot, post–Late Heavy Bombardment lifeless Earth, the <<1% ee_L extra-terrestrial AAs would have been further diluted and over time increased the quantity of perfectly racemic AAs.

Homochiral biomolecules such as DNA, RNA and proteins are indispensable for cells. Various naturalist hypotheses have been proposed for the origin of homochirality.[1]

One often encounters claims in the origin-of-life literature that significant L-enantiomeric excess can be produced naturally in proteinaceous amino acids (AAs) by circularly polarized light (CPL) in the UV wavelength range. In 2020 Glavin *et al.* claimed in a review on chiral asymmetry:[2]

> "An avenue that has shown great promise is the preferential synthesis or destruction of a single enantiomer by exposure to ultraviolet circularly polarized light (UV-CPL).[3]"

The often-repeated claims rarely, if ever, provide any details to help determine whether there is any merit to this view, so we will examine and evaluate the key foundational experiments here.

Mechanisms to obtain enantiomeric excess

Buchardt described three different photochemical mechanisms for inducing an enantiomeric excess: asymmetric destruction, partial photoresolution, and asymmetric synthesis.[4] In each case the yield depends on the anisotropy factor *g*, defined below.[4] We will focus on asymmetric destruction in this paper. It is the favoured explanation for most pro-evolutionists. In the next parts to this series, we will discuss suggestions on how CPL could photochemically lead to slight enantiomeric enhancements of AAs.[5,6]

Bonner and colleagues were the first to report preferential destruction of an AA enantiomer using CPL.[7] Leucine (Leu) was selected for study since its D- and L-enantiomers have among the greatest difference in absorptivity (ε) with respect to CPL of all proteinogenic AAs.[8] Preliminary experiments were conducted to find the best wavelength, λ, which would be both strongly absorbed by leucine and maximize the difference in selectivity of absorbance with respect to CPL handedness:

$$\Delta\varepsilon = \varepsilon_{\text{l-CPL}} - \varepsilon_{\text{r-CPL,}} \quad (1)$$

where l-CPL refers to left-handed circularly polarized light, and r-CPL to right-handed circularly polarized light. It was found that racemic leucine samples irradiated using a laser tuned to λ = 212.8 nm produced the largest enantiomeric excesses (*ee*'s).[7]

At this wavelength, r-CPL was found to preferentially decompose the D-leucine enantiomer, and l-CPL the L-leucine counterpart. The ee_D produced was 1.98% after 59% sample photo-destruction, and ee_L was 2.50% after 75% photo-destruction.[7]

The favoured hypothesis for enantiomeric excess assumes chiral photons, found in interstellar and circumstellar UV CPL, selectively destroyed the enantiomer having the larger absorption coefficient, ε, photolytically.[3,9–16] The asymmetric photoreactions are proposed to have occurred in interstellar

space in ices[17,18] and precursors of carbonaceous meteorites before arriving on the early earth.[19–21]

One astronomical model assumes that neutron stars behave as synchrotrons, emitting CPL of opposite chirality above and below the circulation plane of the charge that circles its core.[22] (Man-made synchrotrons are experimental devices which emit CPL above and below the circulation plane having opposite chirality.) This led to the notion that a neutron star may have aimed its right-circularly polarized beam toward Earth, and its left-circularly polarized beam 180° away into space.[22] Of course, there could have been other neutron stars with different orientations, so this theoretical effect would partially or fully cancel.[23]

Key experiments producing enantiomeric excess using UV circularly polarized light

UV electromagnetic radiation ranges from a wavelength of 10 to 400 nm. Carefully planned laboratory experiments have produced small *ee*'s using ultraviolet circularly polarized light (UV CPL).[24] The excesses inevitably require photo-destruction of >>99% of the starting materials, thus demanding impossibly high initial concentrations at some location before delivery to Earth.[24]

Some amino acid enantiomers absorb left- or right-CPL with slightly different strength (anisotropy) at various wavelengths. This difference is called the differential absorptivity, $\Delta\varepsilon$, and the relative difference is called the anisotropy factor, g:[9]

$$g = \Delta\varepsilon/\varepsilon. \qquad (2)$$

The enantiomeric excess resulting from preferential photolysis using CPL is believed to depend only on the anisotropy g and extent of reaction, ξ.[11] The exact relationship is shown in Eqn (3), from which the values in table 1 were calculated:[9]

$$\xi = 1 - \frac{1}{2}\left[\left(\frac{1+ee}{1-ee}\right)^{\frac{1}{2}\frac{1}{g}} + \left(\frac{1+ee}{1-ee}\right)^{-\frac{1}{2}\frac{1}{g}}\right] \qquad (3)$$

In a key study in 2012, Prof. Meierhenrich and colleagues published anisotropy spectra and g_L values for a wavelength range between 130 and 350 nm (see figure 1 and table 1).

The amino acids studied all have one UV-light-absorbing chromophore, the carboxylate anion. The spectra were measured using films of amorphous amino acids sublimated under controlled conditions with CPL provided by a synchrotron radiation facility at Aarhus University in Denmark.[9] The intention was to model interstellar conditions, where organic molecules are believed to sublimate and condense repetitively.[9] Figure 1 also shows the corresponding predicted ee_L values (thin lines, right axis, with values in %).

Until these experiments, only single-wavelength anisotropy values had been reported for AAs in aqueous solution.[25] It is important to recognize that the sign and magnitude of g for most proteinogenic AAs differ according to the wavelength (λ) of the CPL.[9]

The ee_L values in figure 1 and table 1 confirm that relative absorbances of CPL by D- and L-AAs have a mirror image relationship. The relative response is not identical, however, and depends on the wavelength.

As part of this study, the amino acid film on the MgF_2 support was turned around the axis of the electromagnetic synchrotron radiation and the spectra were measured at 0°, 90°, 180° and 270°. The results at these four positions were

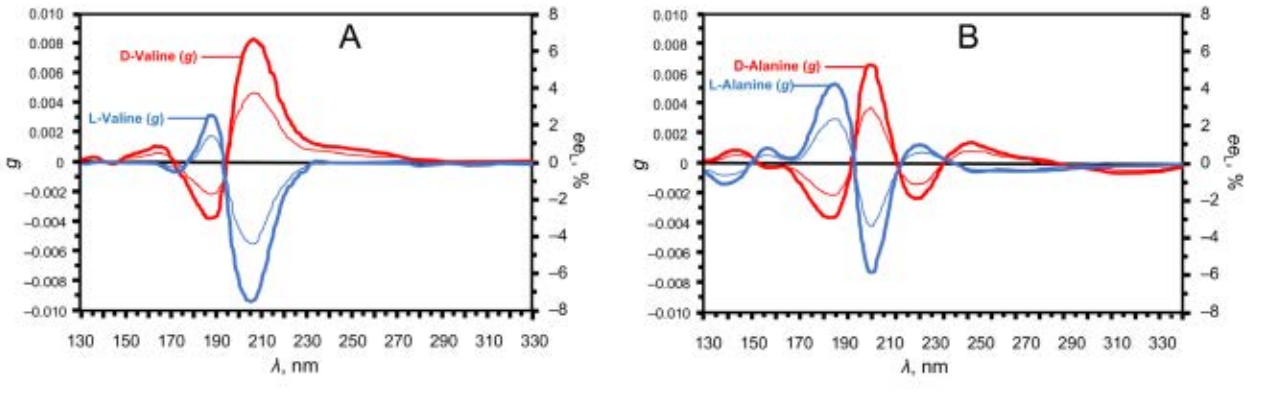

Figure 1. Anisotropy UV spectra (thick lines) and ee_L inducible by either left or right CPL at ξ = 0.9999 (thin lines). **A**: valine, **B**: alanine.[9] After figure in ref. (9).

Table 1. L-Enantiomeric excess (%) predicted for some α-amino acids as a function of the irradiation wavelength, λ (nm), using 100% right-circularly polarized light. Extent of photolysis reaction ξ = 0.9999. Based on a table found in ref. 9.

		Irradiation wavelength (nm)						
Entry	**Amino acid**	**140**	**155**	**170**	**185**	**200**	**220**	**Average**
1	l-alanine	−0.62	0.45	0.33	2.52	−3.33	0.55	−0.02
2	l-valine	−0.03	−0.03	−0.3	1.13	−3.69	−1.15	−0.68
3	l-leucine	0.06	−0.16	−0.64	2.7	4.98	11.31	3.04
4	l-serine	−0.92	0.16	2.19	1.15	−1.14	−2.13	−0.12
5	l-proline	1.26	1.57	−1.34	0.19	−3.81	−0.81	−0.49
6	2-methyl-l-valine	−0.06	−0.24	−0.29	−0.76	−1.2	−1.21	−0.63
7	l-isovaline	−1.12	−2.03	−2.49	−1.68	−3.22	−3.54	−2.35
	Average (1–5):	−0.05	0.40	0.05	1.54	−1.40	1.55	**0.35**
	Average (1–7):	−0.20	−0.04	−0.36	0.75	−1.63	0.43	**−0.18**

nearly identical and anisotropy spectra of separately prepared samples reported to be reproducible.[9]

The reason that leucine is used to claim that enantiomeric excesses could arise naturally is easy to understand. Meinert *et al.* point out that

> "The highest value of *g* measured for these selected amino acids is 0.024 for L-leucine, which is almost one order of magnitude greater than for all other amino acids investigated in this study."[9]

If the goal of such studies had been to discredit the relevance of CPL for origin of life purposes the researchers would have picked almost any of the other biologically relevant AAs.

Asymmetric photolytic destruction

The outcome of enantioselective photolysis of a racemic mixture by CPL is thought to depend on two competitive reactions with different rate constants, k_R and k_S, for the *R* and *S* enantiomer, respectively.[11] The rate constants are proportional to the absorptivity (ε_R and ε_S), and the selectivity of the enantioselective photolysis depends on the difference between k_R and k_S, which can be expressed as *g*, as shown in equation (4):[9,26]

$$g = 2\frac{\varepsilon_R - \varepsilon_S}{\varepsilon_R + \varepsilon_S} = 2\frac{k_R - k_S}{k_R + k_S} \quad (4)$$

The ee_L values reported in figure 1 and table 1 were calculated using the measured anisotropy *g* and extent of reaction $\xi = 0.9999$, using right-handed CPL. Since equation (4) shows that *g* is proportional to $\varepsilon_R - \varepsilon_S$, increasing *g* implies greater $\varepsilon_R > \varepsilon_S$, which results in more destructive photolysis of (R)-AA. Proportionally more surviving (S)-AA is, by definition, an increase in ee_L. (All proteinogenic (S)-AAs are L-AAs except for L-cysteine, which is classified as (R)-cysteine). Conversely, negative values of *g* lead to lower ee_L. Using left-handed CPL would reverse all these effects.

Infrared circularly polarized light

Meierhenrich *et al.* mention in their seminal paper that the Orion molecular cloud interstellar radiation is partly circularly polarized in the infrared wavelength region.[12] (The infrared spectral region lies in the λ = 780 to 1 mm range). For purposes of generating ee_L IR light can't excite amino acid electrons to the high energy states needed for photolysis. The Supporting Information section confirms that for the

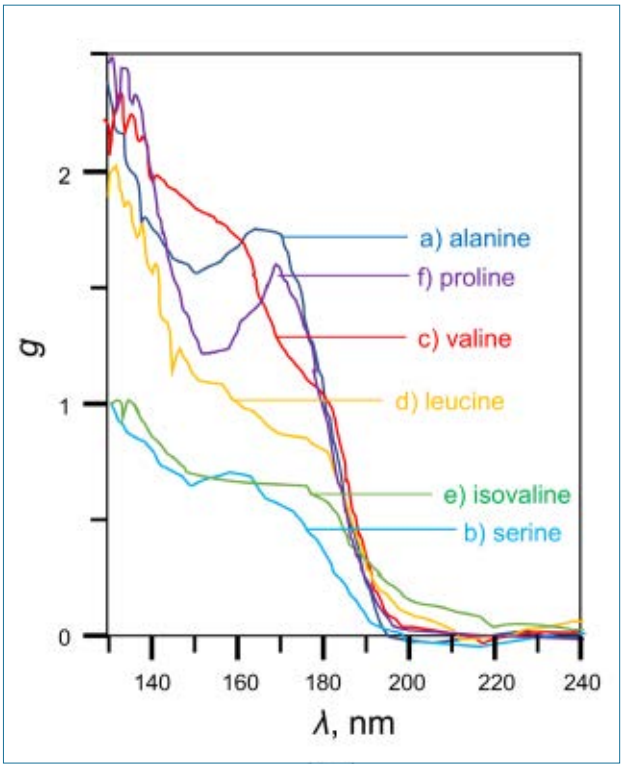

Figure 2. Absorption spectra of solid films of α-L-amino acids in their zwitterionic state: a) alanine, b) serine, c) valine, d) leucine, e) isovaline, f) proline. The light-absorbing chromophore is the carboxyl group. Based on a figure from the Supplementary Materials for ref. (9).

proteinaceous AAs examined, for $\lambda > 220$ nm, ε drops rapidly to zero (see figure 2). [9]

Astronomers have reported, however, that *no polarized UV light could be found anywhere in the relevant region of space*.[23] One group reported in 2005 that they seem to have observed circularly polarized light originating from the region of Orion but only in (irrelevant) infrared frequencies. Infrared light is of too low energy to cause deracemization of the racemic amino acids.[23]

Discussion

Glavin *et al.* noted that the degree of circular polarization (CP) is negligible for stars of mass such as our Sun, but mentioned that some infrared light from the Orion star formation region seems to possess up to 17% polarization for higher mass stars.[2] Therefore, they speculate that CP light having a single sign may have been delivered from a neighbouring massive star, which preferentially destroyed and/or synthesized enantioenriched amino acids. The correct enantiomer would then be incorporated inside comets and asteroids and delivered elsewhere.[2]

> "After calculating the specific *g* values at varying wavelengths, amino acids such as alanine, leucine, and isovaline were predicted to yield enantiomeric excesses ranging from 2 to 5% in quantitative asymmetric photolytic reactions (99.999% extent of reaction, ξ);[9,27] those values are in agreement with the L-enantiomeric excesses found for amino acids present in interstellar ice analogs[5,6,14,28] and those found in carbonaceous chondrites."[29–31]

Claims of agreement between predicted and measured effects from the distant past in the pro-evolution literature always merit careful examination. Alleged small ee_L for alanine and leucine from unambiguously uncontaminated extra-terrestrial sources are controversial at best. (Isovaline is not found in proteins.) Early studies on the Murchison meteorite shortly after it landed in Australia in 1969 and before opportunities for contamination arose reported the absence of an ee_L and used this as evidence that the AAs found were indigenous to the meteorite. I have noticed a correlation between increasing ee_L with time since the meteorite landed. This could be caused by two factors: increasing opportunities for terrestrial contamination and the fact that the most pristine samples, i.e. least likely to have experienced contamination shortly after crashing, were selected first for analysis.

To illustrate the laboratory challenges in determining D/L proportions, in one report Modica *et al.* irradiated a mixture of H_2O, $^{13}CH_3OH$ and NH_3 to show how AAs could form in outer space.[6] The only source of carbon was from methanol which contained only ^{13}C. After some laboratory processing, their mass spectra revealed the presence of ^{12}C fragments, which they attributed primarily to contamination from biological amino acid, despite their careful efforts to avoid this. AAs extracted from meteorites lie in the ppm to ppb concentration range, and biological contamination can only introduce L-AAs, so unfortunately only an infinitesimally small amount would produce incorrect measured ee_L values.

Furthermore, the authors of the original work never predicted AAs ee_L values of 2–5%.[9,27] In fact, Meierhenrich did state: [9]

> "We note that the positions of the extrema as well as their intensity in the newly reported anisotropy spectra differ from those in previously described circular dichroism spectra."

In other words, depending on laboratory details, different *g* values can be obtained. These are technically difficult experiments to perform. In their Supporting Information the authors claim that "Anisotropy spectra of separately prepared samples are reproducible" but no details were provided. [9] Inevitably in these kinds of experiments the estimated errors claimed are based only on repeated gas chromatography (GC) measurements and not repetition of the full experiments. How significant should doubts be about the size of the estimated

g values? When Modica *et al.* applied unpolarized light (UPL) at 122 nm to racemic mixtures, they unexpectedly found enantiomeric excesses for the proteinogenic AAs examined: for alanine $ee_L = 0.46 \pm 0.36$, and valine $ee_L = -0.30 \pm 0.44$.[6] This makes no sense physically and indicates non-neglectable experimental errors are present.

Even small error in *g* values at various wavelengths can have a considerable effect on the estimated *ee* values which result after photo-destroying 99.99% to 99.999% of the initial sample.

We see that there is considerable doubt about both the levels of AA ee_L from extra-terrestrial sources and producible from photo-destruction. On the same page as the quote above, Glavin *et al.* admit:[2]

> "However, UV-CPL-induced enantiomeric excesses observed thus far tend to be significantly smaller than the observed enantiomeric excesses in meteorites."

But this confuses more than enlightens. Enantiomeric excesses of what chemicals in which meteorites? Significantly, unlike α-hydrogen amino acids, the direction of *ee*s produced by isovaline was not affected by irradiation wavelength, but only the light polarization.[2] In other words, ee_L would always be positive or negative for CPL of a given handedness, which is consistent with L-isovaline excess often being reported in meteorites.

The studies on producing an *ee* using CPL provide interesting examples on how evolutionists design experiments which maximize the chances of obtaining the results they hope to find. The approach is not "Let's set up experiments which reflect plausible starting conditions and see what results." We will critically examine the two reasons anything worth publishing was obtained at all:

1. The AAs with the highest *g* factors were selected for study, from which the single best but different wavelengths were used for each AA to predict the highest ee_L theoretically possible.
2. Absurdly high levels of photo-destruction were assumed.

Hypothetical enantiomeric excess based on single optimal wavelength

The CPL generated from experimental equipment is spectrally broadband, and this would be the case also for putative CPL produced extra-terrestrially in the UV range.[6]

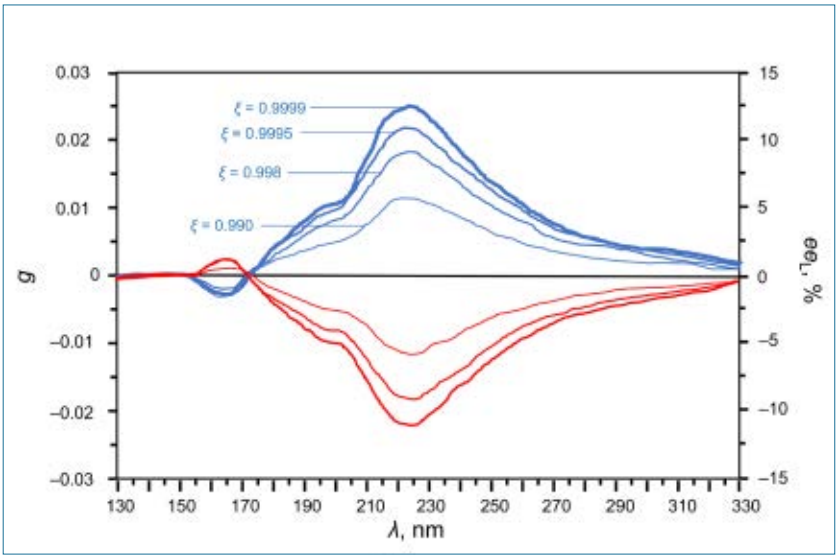

Figure 3. Enantiomeric excess of leucine decreases rapidly with amount of photo-destruction, *ξ* using UV circularly polarized light. L-Leucine shown in blue. After figure in ref. (9).

The absorbances of r-CPL by the five proteinogenic L-AAs reported in table 1 (entries 1–5) were sometimes stronger, other times weaker than their D-AA counterparts at different wavelengths. Therefore, even if no annulling l-CPL were also present, exposure of a racemic mixture of D and L of the same AA to 100% r-CPL would result in a cancelling out effect over the relevant UV wavelength spectrum. The true outcome would be very low overall average ee_L for each AA, see table 1. In fact, the average ee_L's predicted turn out to be negative using the data points shown for all the AAs except leucine!

Proteins require almost pure L-enantiomers for all the AA residues and 5%–10% randomly distributed D-AAs would destroy most proteins.[32] But note that, for the examples in table 1, only at one wavelength ($\lambda \approx 185$ nm) would a positive ee_L value be induced in all the five tested proteinaceous amino acids.[9] The average ee_L at $\lambda \approx 185$ nm was only 1.5%, once again due primarily to only the atypical leucine, see table 1. Incidentally, in a review of AAs found in the extensively studied Murchison meteorite, Koga and Naraoka reported that only trace amounts of Leu had been reported (D-Leu: 80 ppb; L-Leu: 1058 ppb).[33] Large L/D proportions like this are certain to reflect terrestrial contamination, especially taking into account that Leu is the most common AA found in human proteins.[34–36] Our review of the literature showed Leu is not claimed to have been found in, for example, three key Antarctic CR chondrite meteorites (EET 92042, GRA 95229, and GRO 95577);[37] Tagish Lake meteorite samples;[38] Sutter's Mill Carbonaceous Chondrite;[39,40] nor in Aguas Zarcas.[41]

According to table 1, the overall ee_L average is –0.18%, taking all five proteinaceous and two non-proteinaceous AAs into account, and only if 99.99% of the initial AAs were to have photolyzed. Excluding the non-proteinaceous AA data leads to an overall ee_L average of only +0.35% but this includes an abnormally high contribution of 11.31% for L-leucine at $\lambda = 220$ nm.[9] Since there could be multiple sources of polarized UV light and a wide range of absorbing wavelengths, a reasonable prediction would be that no or an insignificant net ee_L would be produced on average naturally via photo-destruction.

Hypothetical enantiomeric excess requires high photo-destruction level

There is no justification for why racemized AAs would have been exposed to only, or almost only, light of the 'correct' wavelength, nor why 99.99% to 99.999% photolysis would have occurred before arriving on Earth. What prevented 99.999% photolysis from becoming 100% amino acid destruction? The evolutionist is faced with a dilemma. To obtain a measurable level of ee_L such as 1%, the total amount of AA surviving photo-destruction and arriving on Earth would be insignificant << (100% – 99.999%). But to deliver more AA, the ee_L would be even closer to perfectly racemic. Figure 3 uses Leu, which displays the greatest g known for AAs, to illustrate how decreasing the amount of photo-destruction c. 1%, from $\xi = 99.99\%$ to 99% about halves the ee_L.[9]

Has a possible solution for enantiomeric excess been found?

The short wavelengths needed for absorption by ordinary amino acids could not have penetrated the putative prebiotic terrestrial atmosphere (having high carbon dioxide content).[42] When might AAs having enantiomeric excess have been produced? Evolutionists believe life could not have survived an alleged Late Heavy Bombardment between 4.0 and 3.8 billion years ago. Any AAs surviving this period being added or produced as the earth cooled over the next millions of years would have been thoroughly racemized.[43] Any slow influx of very dilute extra-terrestrial AAs having an insignificant ee_L would have been immediately diluted by the already racemic AAs and would themselves have also racemized over time.

Assuming millions of years merely increases the amount of potentially contaminating racemized AAs, making it ever more difficult for large homochiral peptides to form. Homochiral peptides in water racemize faster than they can elongate for thermodynamic and kinetic reasons, and ever greater proportions of environmental racemic AAs would only have made matters worse over time.[44]

In conclusion, no astronomical source of r-CPL has been found despite much effort, and the theoretical speculations do not provide a plausible natural solution to the origin of an ee_L for amino acids.

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Racemization of amino acids under natural conditions: part 4—racemization always exceeds the rate of peptide elongation in aqueous solution

Royal Truman and Boris Schmidtgall

Large enantiopure peptides are indispensable for life-related chemistry. We show that peptide elongation in water, starting from the condensation of two amino acids (AAs), is slower than both hydrolysis and especially racemization. For kinetic and thermodynamic reasons, this holds for all plausible naturalistic conditions in aqueous solution, including temperature and pH values. The limited data available support the claim that even if all peptides of length *n* residues would consist initially of only L-residues and be surrounded by pure L-AAs, L → D conversion would outpace the rate of elongation to *n*+1 peptides. We also show that formation of secondary structures which hinder racemization is not a plausible solution to this dilemma. This startling conclusion, if found to always hold, could be applied to all origin of life scenarios which propose ways to amplify L-AAs in some contrived manner, since, even given 100% purity in the unrealistic absence of D-AAs, contamination would not produce large enantiopure peptides.

Cells cannot function without several hundred kinds of proteins, each in multiple copies. Researchers have spent enormous effort trying to find naturalist scenarios to produce these very large peptides, which result from the condensation of amino acids (AAs). Reading the origin of life (OoL) literature, we have noticed a recurring principle. The experimental conditions designed to facilitate AA condensation would automatically also facilitate racemization.

Here, in part 4 of this series, we will propose a startling hypothesis assuming plausible naturalistic conditions in water.

Hypothesis: On average, peptides derived from pools of pure L-amino acids (*L-peptide*$_n$) will convert one or more of their *n* L-residues (L → D) before elongating by one amino acid. This holds for all peptide sizes and temperatures.

This is a remarkable claim. It means that a family of peptides of any length would be assumed to contain only L-residues initially and would be surrounded by a pool of only L-AAs. If every step in such a chain of events were to decrease enantiopurity faster than peptide elongation, then very large enantiopure proteins would not be produced naturally. Introducing more realistic conditions further cements this conclusion, since each sequential elongation would inherit the D-residues of its predecessor peptide plus add D-enantiomers resulting from conversion of any L-enantiomeric excess. As a racemic state [L] ≈ [D] is approached, further net L → D would be slower due to the D → L back reaction, as discussed in part 2 of this series.[1] This of course does not contradict our hypothesis. Long-term racemization in aqueous solution is unavoidable absent specialized enzymes and highly designed processes such as those used by cells.

Our hypothesis stipulates that the initial peptide consists of only *n* residues. We are obviously not claiming that at least one more L-enantiomer will always be converted to a D-enantiomer for all peptides. Should the initial peptide$_n$ consist of [L] ≈ [D], this claim would imply that [D] > [L] would result, which everyone will agree is nonsense. Instead, we are arguing that L-peptide$_{n-3}$ would result in peptide$_{n-2}$ having one or more residues converted to D. If these would be magically reset to L before subsequent elongation, the new pristine L-peptide$_{n-2}$ would have one or more residues converted to D during the process of condensation with an AA to form peptide$_{n-1}$.

Admittedly, the resetting of all generated D back to L will increase the number of positions where L → D could subsequently occur. Clearly, however, the increased number of L residues cannot compensate for having just conceptually eliminated that same number of already fully converted D residues. Since this would hold for *n* of all sizes, initiating condensation from a pool of pure proteinogenic AAs cannot produce large peptides having high L content, as required for biological proteins.

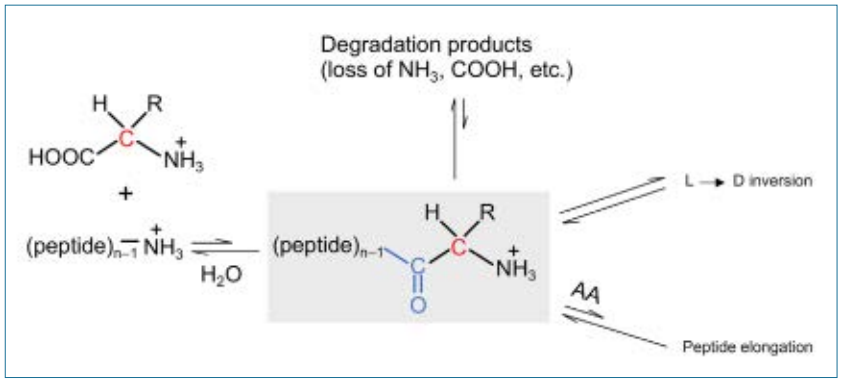

Figure 1. Peptide elongation follows second order kinetics and residue inversion, first order kinetics. End residue emphasized, AA = amino acid. Chiral carbon shown in red, peptide bond in blue.

Table 1. L → D rate constants of some amino acids calculated from the Arrhenius equation at 250°C, a typical temperature for hydrothermal vent simulations.[a] Samples from 0–10 cm depth below seafloor.

Amino Acid	ln(A)	E_a, kjoule	k/year	k/hour
Asx	40.7	118	776437	89.0
Glx	33.6	102	25391	2.9
Ser	34.9	103	74025	8.4
Ala	27.2	86	1672	0.19

[a] We calculated these rate constants using the Arrhenius equation $\ln(k) = \ln(A) - E_a/RT$ using the ln(A) and E_a values provided in ref. 3.

We can make this conclusion more plausible in an easily understood manner. Consider only the end position of $peptide_n$. Once an L-AA is added, that new end residue has a higher probability of being converted to D before the next elongation could occur, since residue inversion is kinetically a first order reaction, whereas elongation is second order, as shown in figure 1.

Furthermore, that end residue has a higher probability of being lost through hydrolysis than subsequent further elongation, and fragments generated from hydrolyzation retain their L or D states. Although this is sufficient to demonstrate the point, a more realistic perspective will help remove any possible doubts. Internal bonds can also racemize but can't condense to form larger linear peptides. Furthermore, a fully formed carbanion intermediate is not necessary for racemization to occur.

If we are right, this would pose a serious dilemma for the OoL community, since we showed in part 1 that only about 5–10% D-amino acids need be present to preclude secondary structures from forming in putative ancestral peptides.[2] Folded proteins cannot be produced without secondary structures.

Trust in deep time to offer opportunities for fortuitous chemical reactions in the face of both unfavourable Gibbs free energy and kinetic rates for amino acid condensation is a conceptual mistake. More time would inevitably increase the density of contaminating racemized AAs in both free form state and chemically bound.

In part 2, we documented the available kinetic and thermodynamic data we were able to find for AA racemization and in part 3 the data related to AA condensation.[1]

Now we must combine data on condensation and racemization, since only large homochiral peptides can fulfill the necessary life-related chemical processes. Ideally the conditions under which peptide elongation and racemization occur should be the same to facilitate the analysis, in the best case as part of the same experiments. Since unfortunately this is rarely if ever done, interpolation and extrapolations must be made here.

We used the Arrhenius equation and data measured by Steen *et al.*[3] to calculate rate constants for L → D of various AAs at 250°C (see table 1), since data is available for amino acid condensation at this temperature.

The amino acid inversion rate constants ranged from 0.19 to 89 /hour, in sharp contrast with the Steen *et al*. experiments which, after considerable optimization, produced a mere ~0.001% $(gly)_8$ condensation product after about two hours. Clearly loss of homochirality at 250°C is many orders of magnitude faster than peptide elongation. We saw in part 2 how small temperature changes greatly accelerate AA racemization.[3] Our analysis of all the data we have been able to access indicates that racemization and condensation slow considerably at ~0°C, but increasing temperature increases racemization far more rapidly than condensation. Furthermore, hydrolysis of $peptide_n$ also increases rapidly with temperature, hindering formation of all larger peptides, but not compensating by any increase of excess L-AAs.

Facilitating formation of peptides accelerates racemization

The peptide end residues are important for the purpose of this paper, which is to compare rates of peptide elongation vs L → D inversion. Producing larger peptides requires reacting an amino acid with either end of an existing peptide. Interestingly, the relative rates of racemization for proteinogenic AAs in peptides follow the relation:

NH_2-terminal > diketopiperazine » COOH-terminal ≈ interior positions ≈ free AA. [1]

Hydrolysis of an end residue produces a stable zwitterion, so these occur more readily than internal peptide bonds.[4,5] Cleavage of an internal peptide bond, however, produces two end residues, which become candidates for hydrolysis. This is another reason that forming large oligomers is so difficult.

That peptide residues racemize faster than free AAs presents a dilemma which naturalists may not be aware of. Ever more ways to facilitate formation of peptides in water might seem useful to create chance opportunities for some life-relevant process to occur, but the more peptides formed, the faster an initial reservoir of excess L-AA would become racemized. The flat carbanion H_3N^+-C^-R-C is stabilized and therefore can form more easily, permitting L → D inversions. In addition, in-chain racemization is especially fast for some residues such as Asn, Asp[6] and Ser[7] through intramolecular racemization catalysis.

I. Peptide growth vs racemization: ΔG is unfavourable

OoL models require large homochiral peptides in high concentrations. But for peptides of any length *n*, elongation and residue racemization occur simultaneously. Our focus here will be on peptide formation in the absence of created cellular machines such as ribosomes.

Suppose a source of pure L-AAs were available to growing chains of peptides. Condensation of every peptide bond, the reverse of hydrolysis, would be thermodynamically unfavourable, in the case of glycine (Gly) by +2.3 to +3.6 kcal/mole for each peptide bond[8] or 3.0 kcal/mole according to others (see table 3).[9–11] For those more familiar with SI units, 1 kcal = 4.184 kJoule. Clearly the equilibrium for dissolved peptides favours $[peptide_n] << [peptide_{n-1}]$.

In contrast, L → D inversion for residues in peptides is rarely unfavourable, with ΔG ≈ 0.

Case 1: random coil peptides

For small peptides in aqueous solution residue, inversion L → D has ΔG = 0, except for some cases of negligible frequency such as presence of stabilizing secondary structure. Random sequence peptides having lengths up to ~20 residues (the largest peptide produced in water using the non-chiral glycine[12]) will almost all form random coils in water. With the relative concentration of $[peptide]_n$/ $[peptide]_{n-1}$ dropping by about a factor of 50 per residue added,[8] realistically OoL researchers need only focus on Case 1. To illustrate, under realistic abiotic conditions, the molar proportion of $[peptide]_{21}$ per molar AA would only be ~1.3×10^{-35} ($(1/400)(1/50)^{19}$).[13] The concentration of larger peptides would continue to decrease rapidly with size.

Changes in temperature or use of catalysts cannot change the fact that hydrolysis of peptides in water is favoured thermodynamically and hinders peptide elongation.[14] Amino acid inversion does not face this barrier. Destruction of peptides could be slowed down by removing water, but for abiogenesis purposes permanent isolation from water would be equivalent to rendering the peptides no longer existent for OoL-relevant chemistry, and racemization could continue, although more slowly.

Conclusion. For small, random-sequence peptides ~20 residues or less which lack a stable secondary structure, the ΔG for residue inversion will always be less than the ΔG for elongation.

Case 2: peptides with secondary structure

For large enough polypeptides derived from random sequences based on pure L-amino acids, occasionally secondary structures such as α-helices and β-sheets could form. For these the ΔG of condensation should be slightly less unfavourable than +2.3 to +3.6 kcal/mole based on glycine oligomerization,[8] due to a contribution of $-\Delta G_{2s}$ (the free energy due to stabilization by a secondary structure). However, L → D inversions with ΔG ≈ 0 would precede the last AA addition, which led to some secondary structure, seriously hindering these from forming.

Perhaps the entire peptide forms an α-helix or β-sheet. Could an inversion-intolerant L- $peptide_n$ sequence be conceived, possibly already with one or more secondary structures, such that every possible inversion would be less favourable than elongation? This would mean that inversion of every residue, including the end residue where condensation is to occur, must have a ΔG > +2.3 kcal/mole.[15]

What would the maximum ΔG_{2S} penalty be for a residue inversion which disrupts a secondary structure? We could not find the necessary data for a precise answer but can infer that it should rarely, if ever, be more than for peptide elongation, certainly not for every peptide in the theoretical inversion-intolerant peptide. Let us explain why.

The free energy difference between the native folded and denatured states of globular proteins is surprisingly small, typically around –7 kcal/mol at 25°C, with most lying in the range of –5 to –15 kcal/mol.[16,17] Proteins are believed to have optimal sequences to produce stable secondary structures, so peptide sequences able to fold would inevitably have a lower free energy of folding. Assuming ~60% of an average size globular protein (~300 residues) is part of a secondary structure would indicate a ΔG_{2S} of ~ –0.04 kcal/mol per residue at 25°C (i.e. –7 kcal/mol / 180 residues).

Table 2. Reasons why inversion-intolerant peptide residues won't arise naturalistically.

No.	Reason
1	In aqueous solution, $[poly_n]/[poly_{n-1}] \approx 1/50$ and $[poly_2]/[AA_1]\ [AA_2] \approx 1/400$. Hydrolysis of peptides produces a build–up of D–AA, so even without external contamination the proportion of pure L–AA will steadily decrease with time in a theoretical sheltered environment. Free–form L–AA produced from hydrolysis will also convert slowly to D enantiomer and potentially be added to another peptide.
2	For small peptides, ΔG inversion < ΔG elongation, so ever more D would be generated and inherited during elongation in addition to being incorporated from the increasingly contaminated feedstock.
3	At least 7 contiguous residues having only L–AAs are necessary for β–sheets to form under the most optimal conditions, such as high concentration of the right metal cation, but the average $peptide_7$ would already have multiple D–residues.
4	Large peptides are needed to permit a secondary structure to be generated by chance. D–AAs would continue to be incorporated into elongating peptides, making it increasingly difficult for suitable enantiopure hydrophobic/hydrophilic patterns to be present.
5	The amount of larger $peptide_n$ would be vanishingly small, providing fewer opportunities to generate alternative sequences.
6	Of the insignificant number of large peptides formed, only a small fraction would contain residues with suitable steric and hydrophilic/hydrophobic patterns able to sustain stable secondary structures. For example, glycine would have been the dominant AA according to OoL researchers, hindering formation of hydrophilic / hydrophobic patterns.
7	If weak and fleeting secondary structures involving ≤20 residues were formed, individual residue disruption would have a negligible +ΔG penalty. Residue inversion would continue unhindered, since hydrolysis would not be slowed down, and elongation would not be enhanced.
8	The inevitable result would be trace amounts of larger $peptide_n$ with racemic DL residues and no secondary structure instead of a high concentration of optimized inversion-intolerant peptides. In Part 1 we showed that the presence of only ~5% D–AAs would prevent formation of secondary structures.

This suggests that a secondary structure involving twenty residues would contribute a $\Delta G_{2S} \approx -0.8$ *kcal/mole* (–0.04 × 20). The penalty for disrupting a secondary structure would therefore be considerably lower than for condensation, and, once disrupted, subsequent inversions would be back to $\Delta G \approx 0$. Multiple inversions would accumulate, and hydrolysis would dominate with hydrolysis 50 times more probable than elongation.

Conclusion. For larger random-sequence peptides containing secondary structures not deliberately designed to resist residue inversions, the ΔG for residue inversion will be less than the ΔG for elongation.

We suspect it would be possible to design an exceedingly inversion-intolerant $peptide_n$, which is why we formulated the conclusion as we did. But this would not have arisen naturalistically and would be an example vanishingly unlikely to be useful for sensible OoL purposes.[18]

Our scenario presumed an absurd initial environment of a small amount of 100% pure L-AAs with no possibility of contamination for millions of years. We will retain this OoL-friendly scenario but explain in table 2 why a sophisticated inversion-intolerant peptide won't arise naturalistically.

At what peptide size would one need to consider the presence of secondary structures at all? These structures require enough residues for a measurable amount of stability.

In one experiment Brack and colleagues were able to induce a helix structure based on designed $(Leu\text{-}Asp\text{-}Asp\text{-}Leu)_n$-Asp peptides between 13 and 25 residues long if the right concentration of Zn^{2+} was added, but the sensitivity to L → D substitution was not reported.[7] Brack *et al.* also showed, in the 1970s, that $(Leu\text{-}Lys)_n$ β-sheets are very sensitive to the incorporation of about 5% D-isomer and will only form with *seven or more of the correct homochiral* residues in a row. Even this was only possible under optimized conditions, such as including the right coordinating metals and an aqueous medium with high ionic strength.[7,19–21]

These and similar studies use only a small subset of the appropriate AA residues having the correct hydrophilic–hydrophobic (Hi-Ho) pattern, under unrealistic and optimized conditions. Only weak and fleeting secondary

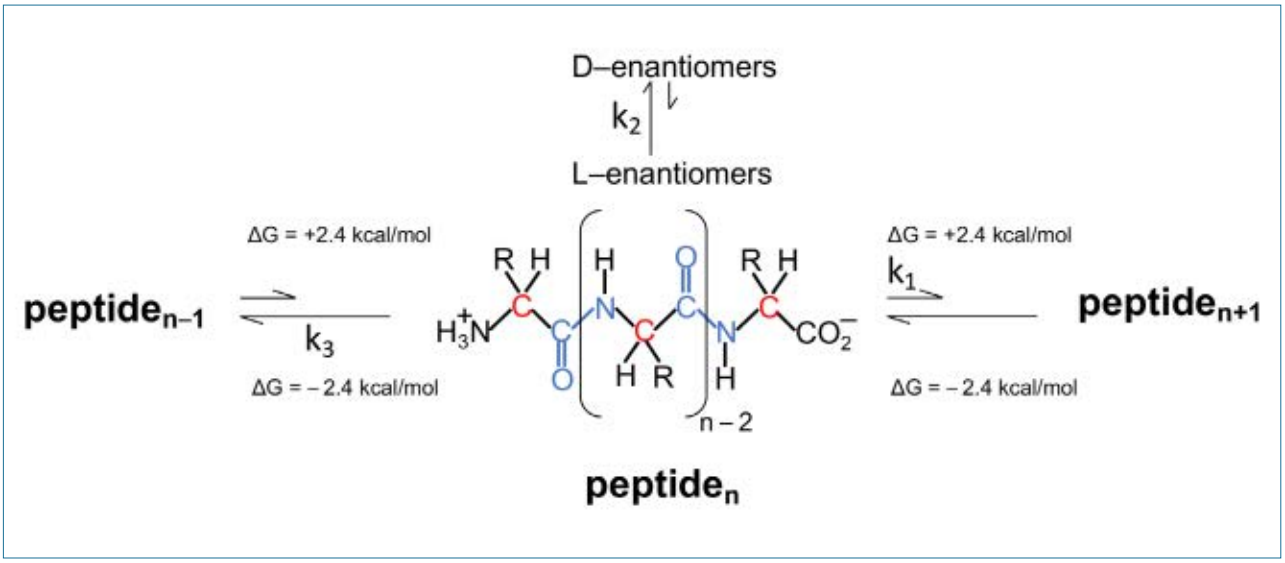

Figure 2. Peptide elongation competes with peptide hydrolysis and residue inversion. Chiral carbons are shown in red, peptide bonds in blue.

structures were formed, the disruption of which would have a negligible +ΔG.

II. Peptide growth vs racemization: kinetic rates are unfavourable

A fundamental question now arises. ΔG considerations address long-term equilibrium state conditions. But could loss of enantiopurity of L-peptides occur faster short-term than increase in peptide size in naturalistic settings? The most favourable abiogenesis scenario involves a pool of 100% pure AAs initially. A given L-peptide$_n$ faces several possible fates, in addition to decomposing chemically (see figure 1). It could condense with an AA with rate constant k_1; invert one or more L-AAs with rate constant k_2; and hydrolyze an end residue with rate constant k_3 (see figure 2).

We will neglect for the moment other possibilities, such as loss of end amino or carboxyl groups, or dehydration reactions.

$$\text{peptide}_n + \text{AA} \rightarrow \text{peptide}_{n+1}, \text{ at a rate } k_1 \times [\text{peptide}_n] \times [\text{AA}] \quad [2]$$

$$\text{peptide}_{n\,(L=l)} \rightarrow \text{peptide}_{n,(L=l-1)}, \text{ at a rate } k_2 \times [\text{peptide}_n] \quad [3]$$

$$\text{peptide}_n + H_2O \rightarrow \text{peptide}_{n-1}, \text{ at a rate } k_3' \times [\text{peptide}_n] \times [H_2O] \quad [4]$$

where $k_3 = k_3'[H_2O]$.

Note that [2] is a second order reaction whereas [3] is only a first order reaction. In [3] the number of L-AAs decreased from l to l–1. In [4] the high concentration of water was incorporated into the k_3 rate constant, since it remains essentially constant. Internal bonds could also hydrolyze besides the end residues. This would strengthen our case, since now the fraction of larger peptides has been decreased even more. Note that any AA inversion would persist if condensation or hydrolysis occurs, whereas the rate of elongation has decreased when hydrolysis occurs. This contributes to residue inversion occurring more frequently than peptide elongation.

As shown above, the Gibbs free energy of amino acid condensation is strongly unfavourable, so the long-term equilibration outcome would be mostly zwitterions in water. Therefore, abiogenesis scenarios must demonstrate that shorter term kinetic effects permit large homochiral peptides to arise temporarily. This means that AA condensation and racemization need to be measured and reported under the same conditions. This is rarely, if ever, done, and the ubiquitous experimental use of glycine hides this fact.

We searched the literature for kinetic data on peptide formation in water and AA racemization in peptides, as shown in table 3.

We could not find literature data for rate constants of condensation reactions such as [5] and [6] and must rely on a reasonable proxy for them:

$$2 \text{ zwitterions} \rightarrow AA_2 \quad [5]$$

$$AA_n + \text{zwitterion} \rightarrow AA_{n+1} \quad [6]$$

Our reasoning is as follows. Condensation is in equilibrium with peptide hydrolysis (see figure 3), permitting us to calculate the energy of activation, E_a for condensation as ~+26 kcal/mol.

Table 3. Available literature values for rate constants of peptide bond formation and amino acid residue racemization

Formation peptide bond			**Rate constants /year**	
Reaction	**ΔG_h[a]**	**E_a, Kcal/mol**	**25°C**	**150°C**
2 Gly → $(Gly)_2$[b]	+3.6	26.6	$<2 \times 10^{-3}$[b]	<281[c]
$(polyG)_{n-1}$ + G → $(polyG)_n$[b]	+2.3	25.3	$<2 \times 10^{-3}$[b]	<281[c]

L → D conversion[d]			**Rate constants /year**					
Amino acid	**ln(A)**	**E_a, Kcal/mol**	**25°C**[e]	**150°C**[e]	**49.5°C**[f]	**58.5°C**[f]	**77°C**[f]	**105°C**[f]
Asx	40.7	28.2	1×10^{-3}	1,270	0.0421	0.081	2.1	17.3
Glx	33.6	24.4	0.5×10^{-3}	99	0.0068	0.036	0.182	2.98
Ser	34.9	24.6	1×10^{-3}	2,734	0.0275	0.069	0.718	6.68
Ala[g]	27.2	20.6	0.6×10^{-3}	16	0.0142	0.016	0.0639	1.33
Asp[h]	22.3	<18.4	$>63 \times 10^{-3}$	>601	>0.666	>1.45	>6.32	>44.7
	Average:	**~23**						

(a) Overall free energy of peptide bond hydrolysis.
(b) 6.3×10^{-11} /sec was reported in ref. 22.
(c) 8.9×10^{-6} /sec was reported in ref. 22.
(d) Samples taken from the surface of ocean water, ref. 3. E_a were reported in kJ/mol, and converted to facilitate comparisons. 4.184 j = 1 cal.
(e) We calculated these values using the ln(A) and E_a values reported in ref. 22. $\ln(k) = \ln(A) - E_a/RT$.
(f) Rate constants reported in ref. 22.
(g) At 0°C, $\ln(A) - E_a/RT = 27.2 - 37.92$, indicating $k = 2.2 \times 10^{-5}$ /yr; Bada estimated 1×10^{-4}/year, assuming about 17% of alanine dissolved in natural waters would be chelated by Cu^{2+}, at pH 7.6, ref. 23. The unchelated rate constant increased by a factor of 100 when the temperature was increased from 0°C to 25°C. This suggests the racemization rate constants could be significantly higher for AAs chelated and dissolved in ocean water instead of in a sedimentary layer.
(h) We calculated the rate constants using the E_a and ln(A) provided in ref. 3.

We propose to use values for k_3 as defined in equation [4] for the hydrolysis reaction $peptide_n + H_2O \rightarrow peptide_{n-1}$ as proxies for k_1 in equation [2], since clearly $k_3 >> k_1$. (Recall that k_3 incorporates $[H_2O]$. Incidentally, water is also involved in stabilizing the transition state of the condensation reaction.[22]) Higher temperature hydrolysis experiments have been conducted using glycine,[8] and the ln(A) and E_a values needed for the Arrhenius equation were reported, which permits us to calculate k_3 at different temperatures. The E_a of condensation will be the same as for hydrolysis plus 2.3 to 3.6 kcal/mol to bring the zwitterion reactants to a neutral AA state in water.

The ~26 kcal/mol E_a for condensation is greater than the average E_a of racemization for AAs per peptide bond (~23 kcal/mol), table 3. But the E_a is not the only factor affecting rate constants. In the Arrhenius equation

$$k = Ae^{-Ea/RT} \qquad [7]$$

the pre-exponential factor *A* is interpreted as the number of collisions per second occurring which have the proper orientation to react. For the three partners, i.e. AA, peptide and water molecules, to be properly positioned for the transition state geometry in the condensation reaction will be less frequent by chance than the necessary configuration for hydrolysis, which involves only $peptide_n$ and water to be properly positioned. Therefore, we expect the *A* term to also support our claim that $k_1 << k_3$.

This brings us to a simple but fundamental insight. For peptide elongation to outpace racemization, equation [8] would be necessary:

$$k_1[peptide_n][AA] > k_2[peptide_n] \qquad [8]$$

Since $k_3 >> k_1$, we can replace k_1 by our proxy k_3, which implies

$$k_3[peptide_n][AA] > k_2[peptide_n]. \qquad [9]$$

Since [peptide$_n$] is the same on both sides, and only L-residues are assumed, the fundamental requirement becomes

$$k_3[AA] > k_2. \qquad [10]$$

From table 3 we see that the average k_3 values at 25°C and 150°C are smaller than k_2. To make matters worse, any plausible pre-biotic concentration of proteinogenic AAs in water must be [AA] << 1 M. For example, Bada estimated it to be ~10^{-10} M in prebiotic oceans.[23] Therefore, [10] cannot be true, and thus [8] even less so. We should recall that [8] already dramatically favoured an OoL perspective by assuming 100% pure L-AAs in a relevant environment and no contamination by D-AAs until some form of life had arisen.

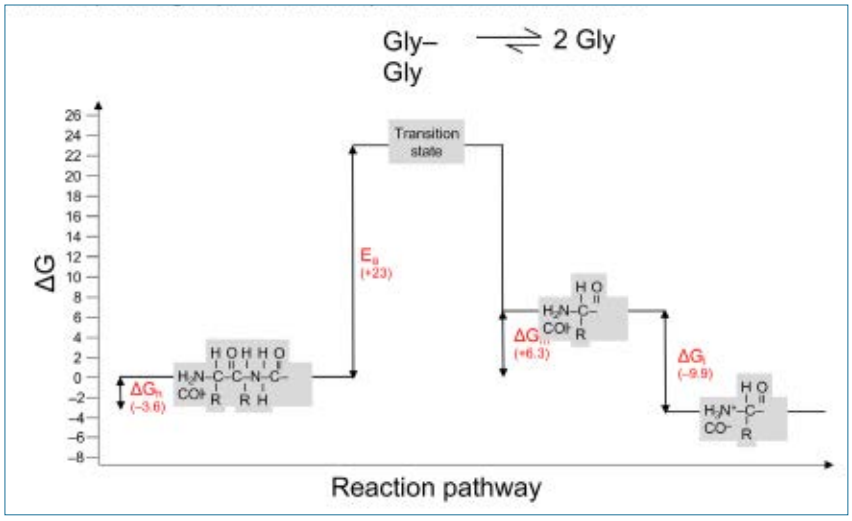

Figure 3. Free energy and energy of activation to hydrolyze Glycylglycine $(Gly)_2$ at 25°C
ΔG_h = overall free energy of amide hydrolysis (−3.6 kcal/mole) ref. 8
ΔG_i = free energy of ionization (−9.9 kcal/mole) ref. 8
ΔG_m = free energy of hydrolysis of the amide bond to uncharged products (+6.3 kcal/mole) ref. 8
E_a = Energy of activation for hydrolysis of Gly-Gly terminal bond (+23 kcal/mole), ref. 21

Conclusion. Even excluding contamination by external D-amino acid, L-peptide$_n$ would add D-amino acid content at a rate faster than peptide elongation in aqueous solution for all plausible reaction conditions.

Taking additional facts into consideration further emphasizes this conclusion.

- L-AAs in the isolated 'feedstock' would actually racemize over time.
- The effect of hydrolysis of peptide$_n$ to decrease the size of peptides was neglected in our mathematical analysis, although this generates another end-residue which racemizes faster than elongation. All D-AAs generated in the end-residue which hydrolyze would further enrich the feedstock with D-AAs (i.e. even without external contamination).
- Chemical decompositions of peptide$_n$ through loss of amino or carboxyl groups at the end position would discontinue peptide elongation, but the residues would continue to racemize and hydrolyze, enriching the feedstock with D-AAs. Even though we generously assume all L-peptide$_n$ during the elongation interval consist of pure L-residues, the AA they condense with would be increasingly likely to be a D-AA.
- In part 2 we mentioned many ways racemization can be accelerated under natural conditions, such as the presence of bases and various aldehydes.[1]

Concluding comments

That racemization will outpace the increase of [peptide$_n$] → [peptide$_{n+1}$] under naturalistic conditions for all values of *n* and all temperatures holds for all the data we have analyzed. To illustrate, Bada calculated that at pH 7.6 and 0°C in oceans the presence of small quantities of chelating Cu^{2+} lead to a rate constant for racemization of alanine ≈ 1×10^{-4} /year.[22] But under these conditions no detectable amount of peptide would be produced. At the other extreme, at 250°C, racemization rate constants are predicted in the timeframe of hours (table 1), but peptides would be instantly hydrolyzed.

Even having assumed an initial pool of pure L-AAs, we have showed that at every stage of L-peptide$_n$ elongation > 1.0 residues on average would convert to D per increase in oligomer by one residue. We know that only 5–10% D-residues randomly distributed in peptides would 'ruin' them for life-related chemistry, but for OoL purposes very large homochiral peptides are indispensible.[2] We have not modelled racemization of peptides over time initiated from pure L-AAs, only shown that these large homochiral peptides could not have formed naturalistically. To introduce more realism, we should not forget that peptides which elongate would inherit the D-residues which had not reverted to L-residues, and hydrolysis of internal peptide bonds would produce smaller fragments, which would also retain their D-residues. Over time the D/L would approach 1 even if an enantiomeric excess of free L-AA surrounded the peptides.

Any L-AA just added to a peptide would face a faster rate of inversion than elongation of yet another L-AA.

If our conclusions hold, forming large peptides with very high enantiomer excess of L-residues will not occur under naturalistic conditions. This is true for thermodynamical equilibrium and kinetic reasons. Therefore, condensation and racemization should be measured under the same experimental conditions in all origin of life related experiments. Otherwise, the relevant question of how to produce large homochiral peptides has not been addressed and the failure to do so will not be apparent to most readers. For example, Cronin's valuable technology,[12] used to perform systematic evaluations of reaction parameters, should be repeated with other pure proteinogenic L-amino acids instead of glycine and the rate of transformation to D-residues measured over time. Glycine is incapable of forming L-peptides and is therefore irrelevant to abiogenesis. Life could not have originated from a collection of poly-glycines.

It is our deep wish to see detailed experiments carried out for a variety of proteinogenic AAs to quantify rate constants, E_a and ΔG for hydrolysis, racemization, degradation, and elongation steps under all relevant parameter settings. Being operational science, this could be a collaboration among those having different views on origins. Attempts to resolve the dilemma we have posed will surely involve the use of non-water polar solvents and special catalysts, which are however dubious proposals for OoL purposes.

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Revisiting *Homo floresiensis*

Peter Line

Here, many aspects of the *Homo floresiensis* finds are considered, including dating, tools, contrasting views, and morphology, particularly regarding the LB1 skeleton. Cretinism, a likely explanation, is also discussed.

In late October 2004, newspaper headlines, such as "Lost race of human 'hobbits' unearthed on Indonesian island",[1] brought to mind J.R.R. Tolkien's Middle-earth. If indeed the hobbit (its nickname) fossils represent a new 'hominin' species (named *Homo floresiensis*), then the media attention surrounding the find would be warranted, but that is a big 'if'. The hobbit was never expected in any evolutionary narrative; it was incorporated *ad hoc* and patchily into an evolutionary story after its discovery.

When the *Homo floresiensis* remains from Liang Bua, Flores Island, were first published, the authors believed they were dealing with a dwarfed *Homo erectus* species.[2] Originally the stature of the partial skeleton of the main fossil specimen (LB1) was estimated at 106 cm, its cranial capacity at 380 cc (cubic centimetres), and its date to 18 ka (thousand years ago).[3]

Remains

The recovered elements of the LB1 partial adult skeleton (the holotype of *Homo floresiensis*) included "the cranium and mandible, femora, tibiae, fibulae and patellae, partial pelvis, incomplete hands and feet, and fragments of vertebrae, sacrum, ribs, scapulae and clavicles."[4] The LB1 skeleton (figure 1) was found in Sector VII, with there being "no stratigraphic or artefactual evidence for deliberate burial."[5]

In 2005, further *Homo floresiensis* remains, from excavations carried out in the Liang Bua limestone cave (figure 2) in 2004, were described. These included "arm bones belonging to the holotype skeleton, a second adult mandible, and postcranial material from other individuals."[6] From this the researchers concluded that at least nine individuals were represented in the excavations up to the end of 2004, from Sectors IV, VII and XI.[6]

Dating

According to Morwood *et al*. in 2004, "Dating by radiocarbon (^{14}C), luminescence, uranium-series and electron spin resonance (ESR) methods" indicated the existence of *Homo floresiensis* from before 38 ka until at least 18 ka (date of LB1).[7] However, the above ages were discarded in 2016, with new dates obtained from various techniques, including ^{234}U/^{230}Th dating, infrared stimulated luminescence (IRSL) dating, thermoluminescence (TL) dating, radiocarbon (^{14}C) dating of charcoal, and ^{40}Ar/^{39}Ar methods.[8] As stated by Gramling, "many of the same scientists who made the discovery have radically revised their estimate of the fossils' age [LB1 dated 18 ka], based on an exhaustive new analysis of the cave's geology."[9] In the new results, Sutikna *et al*. reported that "the skeletal remains of *H. floresiensis* and the deposits containing them are dated to between about 100 and 60 kyr ago, whereas stone artefacts attributable to this species range from about 190 to 50 kyr in age."[10]

The LB1 specimen, previously dated to supposedly 18 ka, yet now from about 60 to 100 ka, appears to predate the arrival of *Homo sapiens* in the region, according to the evolutionary timeline. For an evolutionist, this makes it difficult to argue that the hobbit was a pathological modern human. Whatever the justification for the redating, the new age range certainly was convenient to those believing *Homo floresiensis* represented a new hominin species, as indicated by Gramling:

> "That new, much older date range for *H. floresiensis* makes it 'impossible to argue that it is a pathologically-dwarfed modern human,' says Russell Ciochon, a paleoanthropologist at the University of Iowa in Iowa City who was not involved in the study. 'In my opinion, this paper drives the final nail in the coffin' of that hypothesis."[9]

Whether those (evolutionists) advocating the pathological modern human hypothesis were silenced by the new dating is unclear, but they have been very quiet since. From the creation viewpoint, both the old and new dates are rejected, and so have little bearing on the interpretation of *Homo floresiensis* presented here. The redating illustrates the fickle nature of age estimates obtained from dating methods, as does the comment on it by Hawks:

> "The new understanding of the stratigraphy of Liang Bua is just one step in this process, and we should expect that the geological age of these fossils

Figure 1. A replica of the partial skeleton of the adult *Homo floresiensis* LB1 specimen (probably female) displayed at the Smithsonian National Museum of Natural History, Washington, DC, in 2013 (photo by Peter Line).

will continue to be refined. Indeed, the most current result may itself turn out to be wrong, and we'll need to change ideas again. Stranger things have happened before. Much stranger."[11]

Australopithecine or *Homo habilis*

With a tiny stature and a very small brain, we must ask why *Homo floresiensis* was not initially classified as an australopithecine or a member of *Homo habilis* sensu lato (incorporating *Homo rudolfensis*). Whether the supposed geological age of *Homo floresiensis* is 18 ka, or 50 to 190 ka, it is still long after what evolutionists believe was the last known appearance of the genus *Australopithecus*, about 1.9 Ma (million years ago), or 0.87 Ma if you include the robust australopithecines in the genus *Australopithecus*.[12] The last known appearance of specimens evolutionists assign to *Homo habilis* sensu lato is allegedly 1.65 Ma.[12] Hence, if *Homo floresiensis* was an australopithecine it would mean, from an evolutionary perspective, a total revision of when these primates lived.

Also, as concluded in a lengthy examination elsewhere, *Homo habilis* sensu lato is a composite species, consisting mostly of specimens that can be incorporated into the australopithecine group (i.e. associated with the genus *Australopithecus*), as well as a few *Homo erectus* specimens wrongly categorized.[13] Hence, *Homo habilis* is an illusory species. I regard all australopithecines, including the ones evolutionists assign to *Homo habilis* sensu lato, as extinct apish primates.

Apart from morphology (more later), another problem with attributing *Homo floresiensis* to the australopithecines is that the latter are believed by evolutionists to have originated in Africa, and are currently only found in Africa,[14] as are those specimens assigned to *Homo habilis* sensu lato.[15] Consequently, for them to travel from Africa to Flores Island, Indonesia, requires migrating a considerable distance on land without leaving a trace in the fossil record, then building watercraft for the final part of their journey, the latter a feat seemingly beyond their level of intelligence.

Tools

The stone artefacts associated with the *Homo floresiensis* finds raise a problem with attributing the maker of the artefacts to the australopithecines, as that implies they had human-like intelligence. According to Wong:

> "Earlier hominids with brains similar in size to that of *H. floresiensis* made only simple flake tools at most. But in the same stratigraphic levels as the hominid remains at Liang Bua, researchers found a suite of sophisticated artifacts—including awls, blades and points—exhibiting a level of complexity previously thought to be the sole purview of *H. sapiens*."[16]

Evidence indicates that the toolmakers at Liang Bua were able to use fire and hunt dwarfed stegodonts, indicating they were very intelligent.[17] If LB1, and other individuals regarded as *Homo floresiensis*, suffered from pathology, it is unclear whether they participated in making and using the tools, or whether the tools were made and used by non-pathological individuals of the same human population.

The finding of stone tools on Flores had previously been reported. This was at Mata Menge, and dated to between supposedly 0.80 and 0.88 Ma. The artefacts were said to have been "produced by *Homo erectus* rather than *Homo sapiens*."[18] According to Morwood *et al.*:

> "Even at times when the sea level was lowest, water crossings were necessary to reach Flores from Southeast Asia. We conclude that *Homo erectus* in this region was capable of repeated water crossings using watercraft."[19]

The authors did not believe *Homo sapiens* existed around 0.8 Ma, and so attributed the manufacture and use of

the artefacts, as well as the ability to make water crossings, to *Homo erectus*.

A later paper on excavations at Mata Menge suggested that

> "... the stone artefacts from Mata Menge and Liang Bua [the ones associated with *Homo floresiensis*] represent a continuous technology made by the same hominin lineage."[20] The authors stated that "the age of the site [Mata Menge] clearly *precludes* modern humans", with the "the first skeletal evidence currently available for modern humans on the island, at Liang Bua around 10.5 kyr BP," being "associated with various changes and additions to the stone artefact record".[20]

Contrasting views

The position on the original paper announcing the 'new' species *Homo floresiensis* was that the "most likely explanation for its existence on Flores is long-term isolation, with subsequent endemic dwarfing, of an ancestral *H. erectus* population."[4] However, several years later, at least some of the authors did an about-face, concluding:

> "… that the Liang Bua individuals collectively have such a range of primitive morphological traits that they are unlikely to be derived from insular dwarfing of an ancestral *Homo erectus* population, as we assumed in the initial description of *Homo floresiensis*."[21]

According to the late Mike Morwood and Penny van Oosterzee:

> "Instead, morphological traits of *Homo floresiensis* indicate that the ancestral population in continental Asia, and subsequently Flores, was a habiline-like, or even more primitive hominid species, with australopithecine body proportions, small brain and short stature. Furthermore, we would argue that this lineage exited Africa between 2.6 and 1.8 Million years ago—i.e. after hominids began making stone artefacts, but before hominids occupied Dmanisi."[22]

But in 2011, the original 'Hobbit' position seemed back in favour, at least among some experts:

> "… we conclude from detailed study of LB1 craniofacial shape and surface morphology that this endemic species could have descended from an early Pleistocene *H. erectus* population in Java or elsewhere in Southeast Asia. If so, then the process would have included drastic body and brain size dwarfism and facial gracilization, as originally proposed."[23]

After the 2016 announcement of additional *Homo floresiensis*–like fossils, including a mandible fragment and six isolated teeth, from at least three individuals, dated to supposedly ~0.7 Ma, at Mata Menge, Flores,[24] paleoanthropologists Spoor and Stringer agreed that *Homo erectus* was "now the best fit for the hobbit's ancestor."[25] According to van den Bergh *et al*.:

> "The Mata Menge fossils are derived compared with *Australopithecus* and *H. habilis*, and so tend to support the view that *H. floresiensis* is a dwarfed descendent of early Asian *H. erectus*. Our findings suggest that hominins on Flores had acquired extremely small body size and other morphological traits specific to *H. floresiensis* at an unexpectedly early time."[24]

It is not unreasonable to suggest that the finds from Liang Bua (*Homo floresiensis*) and Mata Menge are related, although the small mandibular fragment (SOA-MM4 right mandibular corpus) from Mata Menge, believed to be from an adult individual, and the other small, isolated teeth also from the same location, do not reveal much except that there were small-jawed individuals living there.[26]

While SOA-MM4 indicates a very small individual, the jaw seemingly smaller than the jaws at Liang Bua, its mandibular corpus (body) dimensions (e.g. corpus height at M2: 18 mm; corpus width at M2: 12.5 mm[27]) appear comparable in size to the very small human KRM 16424 adult right lower jaw fragment (corpus height at M2: 20 mm; corpus width at M2: 13 mm[28]) from Klasies River Mouth, South Africa. The 'Klasies Middle Stone Age' people were regarded by Rightmire and Deacon as having "robust but essentially modern anatomy."[29] Hence, small jaws, whether from Liang Bua or Mata Menge, cannot be used as a reason for not classifying them as human. Also, humans small in stature are common on Flores today,[30] so it should not be unexpected to find them having lived there in the past.

A 'phylogenetic' analysis by Argue *et al*. in 2017 suggested that "*H. floresiensis* is a long-surviving relict of an early (>1.75 Ma) hominin lineage and a hitherto unknown migration out of Africa, and not a recent derivative of either *H. erectus* or *H. sapiens*."[31]

With such different positions on *Homo floresiensis* by those who believe it is a new species, they can hardly complain that other, non-evolutionary, positions have been put forth as explanations. During the early days of the hobbit controversies there was a focus on microcephaly as explaining *Homo floresiensis*, at least regarding the LB1 specimen, as discussed by me earlier.[32,33] Microcephaly is a pathological condition where the human brain does not develop properly, resulting in a head smaller than normal. Any explanation of the LB1 specimen needs to account for its abnormally small brain.

Apart from a human with microcephaly,[34–37] other possible human pathologies suggested to explain the *Homo floresiensis* LB1 specimen have included Laron Syndrome,[38] myxoedematous endemic cretinism,[39] Down Syndrome,[40] and an unspecified developmental abnormality.[41] Gary Richards suggested that the individuals attributed to *Homo floresiensis* represented a variant of *Homo sapiens* "possessing a

Figure 2. The Liang Bua Cave on the island of Flores, Indonesia, where the remains of *Homo floresiensis* were first discovered in 2003

combined growth hormone–insulin-like growth factor I axis modification and mutation of the MCPH gene family."[42] It is not here the goal to explain and contrast these positions. In the following sections, some features of interest in *Homo floresiensis* are described, along with plausible explanations involving cretinism where relevant.[43]

Limb proportions and stature

Compared with modern humans, the arms of LB1 are long in relation to the legs.[44] The limb proportions, as indicated by the humerofemoral index (ratio of humerus to femur length), was measured to be 85.4 % for LB1. This is said to be outside the range of variation for *Homo sapiens*, but the same as the AL 288-1 (Lucy) *Australopithecus afarensis* skeleton, "and midway between the indices for apes and humans."[45] For comparisons, the estimated humerofemoral index in *Australopithecus afarensis* is 85%,[46] while the mean of a sample of *Homo sapiens* and *Pan troglodytes* (common chimpanzee) was 71.2% and 101.7%, respectively.[47]

According to Obendorf *et al*., "Human cretins have long arms relative to legs, and the humerofemoral index variable and up to 78",[48] which is lower than the index measured for LB1 (85.4), but higher than the mean sample of *Homo sapiens* (71.2). According to Leroi, "Careful measurements of pygmies (and thousands of them have been measured) show that compared to taller people, pygmies have relatively short legs but relatively long arms."[49] Hence, the human body 'sized' down to the pygmy level may result in limbs that do not scale down proportionally. Whether the above explains the humerofemoral index of the LB1 individual is unclear.

According to evolutionist Gary Richards:

> "While noting both local and regional variation in pygmy populations, short-statured populations in Africa and Southeast Asia have a combined range for stature of c. 126.2–172.1 cm for males and c. 116.5–163.0 cm for females … . The Efe and Mbuti pygmies, who inhabit the Ituri forest of Zaire, are considered to have the shortest statures for any living human group, although a normal Aka female possessed a stature of only 116.5 cm … ."[50]

The stature of another *Homo floresiensis* individual (LB8) was estimated, in 2005, to be 109 cm (based on LB8 tibia length), although Morwood *et al*. opined that "LB8 was probably a shorter individual than LB1, who had an estimated stature of 106 cm on the basis of femur length … , a more reliable proxy for stature."[51] Some critics of *Homo floresiensis* as a new species, as opposed to being a diseased human, have claimed that the 106 cm stature estimate of the LB1 height "was the absolute minimum of the actual possible range, reaching as high as 1.35 meters, with an average oscillating height around 1.25 meters—which falls inside the range of statures observed among villagers on Flores."[52] While still low, if the stature of LB1 was towards the higher range of the above estimates, then it would fall within the range of known short-statured populations. A small stature, associated with severe growth retardation, is a feature common in hypothyroid cretins,[53] and so the small stature attributed to *Homo floresiensis* fits the cretinism model.

Pelvis

Anthropologist Aiello is quoted as saying that the pelvis of the LB1 skeleton "'is virtually identical to that of an australopithecine,' much wider than the modern human pelvis".[44] However, according to Richards:

> "Morphological features of the skeleton (wide pelvis, long arms relative to legs, tibial cross-sectional shape, etc.) that are said to link *H. floresiensis* with early hominids are also found in modern human pygmy populations. Some of these features have been described as 'primitive' in pygmies and most are linked to body size reduction."[54]

In the original paper the LB1 pelvis ilium was described as having a 'marked lateral flare' compared with modern humans.[55] About a year later, it was noted that "The more complete left ilium … also indicates that the pelvis is flared antero-laterally, consistent with an australopithecine-shaped thoracic region."[45] However, as stated by Culotta:

> "Although previous publications had described the pelvis as similar to those of the much more primitive australopithecines, Jungers found that the orientation of the pelvic blades is modern. The observation adds weight to the notion that hobbits had *H. erectus*, rather than australopithecine, ancestry."[56]

Although the LB1 pelvis has a lateral iliac flare, the iliac blade surface of its left hip bone (os coxae) LB1/7 is curved due to a concave iliac fossa, not flared with a flat iliac fossa, as in some australopithecines (e.g. AL 288-1).[57] A similar lateral iliac flare (flared but curved) is also found in specimens of *Homo heidelbergensis* (SH Pelvis 1) and the Neanderthals (Kebara 2),[57] that are both undoubtedly members of human groups. Also, lateral iliac flare of the pelvis has been observed in cretinism.[58]

Shoulder joint orientation

Although fragments of the LB1 scapulae (shoulder blades) were reportedly found,[4] further descriptions of these fragments are difficult to find. However, an adult right scapula (LB6/4) from individual LB6 was reported in 2005.[59] LB6/4 was described as a "nearly complete right scapula," and, after measuring several angles on the scapula, Larson *et al*. reported that "None of these angles appears to be statistically different from those of modern humans".[60]

The angle between the ventral bar and the glenoid cavity (ventral bar/glenoid angle) indicates the orientation of the glenoid cavity (the shallow depression on the scapula where the head of the humerus fits), with lower angles indicating more cranially oriented shoulder joints.[61] Regarding the LB6/4 scapula, its ventral bar/glenoid angle was measured to be 157°, said to be "in the range of modern humans".[62]

In 2017 Feuerriegel *et al*. listed the mean ventral bar/glenoid angle for a number of fossil specimens and extant species, including *Homo sapiens* (142.4°), *Pongo pygmaeus/abelii* (orangutans; 131.4°), *Pan troglodytes* (common chimpanzee; 127.9°), *Gorilla gorilla* (130.2°), *Hylobates sp*. (gibbons; 121.1°), KNM-WT 15000 (*Homo erectus*; 137.5°), MH2 (*Australopithecus sediba*; 131.2°), AL 288-1 (*Australopithecus afarensis*; 132.2°), and Sts 7 (*Australopithecus africanus*; 128.0°).[63] This indicates that the shoulder joint of the LB6 *Homo floresiensis* individual was oriented more laterally than the average *Homo sapiens*, and not more upwards, as in apes and the australopithecines. Hence, *Homo floresiensis* individuals, as represented by LB6, were unlikely to have hung in the trees.

The foot

The LB1 partial skeleton is said to include "a relatively complete left foot and parts of the right foot", and according to Junger *et al*.:

> "LB1's foot is exceptionally long relative to the femur and tibia, proportions never before documented in hominins but seen in some African apes. Although the metatarsal robusticity sequence is human-like and the hallux is fully adducted, other intrinsic proportions and pedal features are more ape-like. The postcranial anatomy of *H. floresiensis* is that of a biped."[64]

Consider the large foot of LB1. What at first seems ape-like, when viewed from a different perspective, can have a different explanation:

> "Though cretins have absolutely small feet, they have even shorter limbs so that the ratios of foot length to leg length and lower limb length have values (76–84% and 35–43%) similar to apes. Further, LB1 has ape-like metatarsal and phalangeal ratios, and ape-like morphology of individual tarsal bones. Again, these same features are also found in cretins."[65]

Oxnard explains the relatively large and wide hands and feet (and lower face) in cretins:

> "Thus, though growth is slowed everywhere in cretins, it is slowed relatively less in those parts that, even in normal humans, continue to grow throughout life, hence relatively larger hand and foot skeletons (and also, as it happens, relatively larger lower face and especially lower jaw)."[66]

The proximal pedal phalanges of LB1 were considered relatively long with respect to metatarsal lengths, and moderately curved, compared to the short, straight toes of modern humans.[67] On the medial longitudinal arch of the LB1 foot, Junger *et al*. stated that, as in the australopithecines and great apes, it "was probably weakly developed or absent in LB1", and later that it "lacks a well-defined medial longitudinal arch".[67] A later article by Jungers *et al*. observed the "hallux is fully adducted, but we suspect that a medial longitudinal arch was absent."[68] Hence, while they seem confident that the LB1 foot had an adducted hallux (i.e. the big toe was in line with the other toes, and so non-opposable, as in humans), there is less certainty on the nature of the medial longitudinal arch.

As stated by DeSilva and Throckmorton, "All primates possess a transverse arch, but only humans have a longitudinal arch making non-human primates anatomically and functionally flat-footed."[69] The longitudinal arch is involved in storing elastic energy, and it "maintains the structural rigor of the foot during the push-off stage of

Figure 3. Frontal views of a cast of the Dmanisi (Georgian) *Homo erectus* Skull 3 (left; D2700 cranium and D2735 jaw), a cast of the adult (probably female) LB1 *Homo floresiensis* skull (middle), and a replica adult modern human female skull (right) (photo by Peter Line).

bipedal locomotion".[69] The longitudinal arch also "acts as a shock absorber, mitigating ground reaction forces generated during the foot flat stage of the gait cycle."[69]

However, flatfoot is a frequently encountered pathology in both pediatric[70] and adult[71] human populations, and so cannot be regarded as a 'primitive' condition in modern humans. Consequently, its possible presence in the foot of the LB1 *Homo floresiensis* individual is not that significant, apart from the possibility that it was part of a broader pathology.

The hand

Analysis of three LB1 wrist bones, but particularly the trapezoid, was said by Tocheri *et al*. to show "that it retains wrist morphology that is primitive for the African ape-human clade."[72] However, this 'primitive' trapezoid shape is also seen in cretinism:

> "Small trapezoids do, however, sometimes occur in adult human cretins because there may be delayed ossification of the ventral portion of the bone in younger cretins, or failure of fusion of the two parts of the bone with loss of the smaller ventral portion after death … . A young adult cretin (Basle, specimen 84, male) shows exactly such an incomplete trapezoid lacking a ventral tip adjacent to a normal capitate."[65]

According to Oxnard *et al*., the small LB1 trapezoid does not fit in the carpal row of a chimpanzee but does appear to "articulate well in the shallow dorsal curve of the human carpal tunnel".[65] Hence, what is interpreted as an ape-like trapezoid bone is an incomplete human trapezoid with a missing ventral portion.[73]

The curvature (in dorsopalmar plane) of the shaft of a complete proximal manual phalanx (LB6/8) of the LB6 individual was described as falling "at the extreme upper end of the human range and overlaps with gorillas. It is similar in this respect to A.L. 333w-4, an *Australopithecus afarensis* specimen."[74] The two incomplete proximal manual phalanges (LB1/62 and LB1/61) of the LB1 individual were said to "lack their proximal bases and varying degrees of their shafts", but their shafts were said to "appear to be relatively straight, but this is difficult to judge conclusively without an articular base."[75]

No information appears to be given on the curvature of the intermediate manual phalanges of the LB1 and LB6 *Homo floresiensis* individuals.[76] Hence, when Kivell, regarding the proximal phalanges of *Homo floresiensis*, stated they are "curved to a similar degree as in *Au. Afarensis*,"[77] one presumes she was referring to the proximal LB6/8 finger bone. According to Kivell:

> "… there is a well-documented archaeological sequence at Flores clearly demonstrating that stone tool making and use were part of the behavioural repertoire of *H. floresiensis* from as early as 840 ka … . Thus, the direct association between the largely primitive hand of *H. floresiensis* and stone tools (produced via a simple reduction sequence …) calls into question our traditional assumptions about the necessary morphological features and biomechanical consequences of stone tool production."[77]

Curvature in the fingers is usually caused by mechanical strain from habitual behavior, such as the high loads experienced when grasping during climbing or moving through the trees suspended by the hands.[78,77] However, the curvature could also potentially be caused by habitual tool use, or some other repetitive use of the hands.

As discussed above, the shoulder joint of the LB6 individual indicates it is unlikely that this individual's curved fingers were from hanging in the trees. This conclusion is consistent with that of Peter Brown, the principal author of the first *Nature Homo floresiensis* paper, admitting in *National Geographic*, in 2005, that, regarding the LB1 skeleton, "'Her arms hung almost to her knees', says Brown, but her delicate hand and wrist bones imply that 'she wasn't doing a lot of climbing.'"[79]

That there is 'well-documented' evidence that stone toolmaking and use were part of the 'behavioural repertoire' of *Homo floresiensis*, likely explains the curved fingers in the LB6 individual. There is no cranium for the LB6 individual (only a mandible); consequently the size of its brain is unknown. Brown and Maeda believed the sex of LB6 (an adult) is probably female (as is LB1), and stated that "The LB6 mandible, and its likely associated postcrania, are from a smaller individual than LB1."[80] Whether the LB6 individual was also pathological is more difficult to be definite about than LB1, as it is much less complete than LB1, although those arguing for the cretinism hypothesis believed both LB1 and LB6 were cretins.[81]

Frequent stone toolmaking and use might explain the finger curvature seen in LB6, but whether cretinism contributes to this effect is unclear. This is because the pathological state of the more incomplete LB6 individual appears less certain than LB1, and the proximal finger bones of the partial LB1 skeleton were not complete enough to give a definite answer on whether they were curved or not.

The skull

The initial *Homo floresiensis* paper stated:

> "Although LB1 has the small endocranial volume and stature evident in early australopithecines, it does not have the great postcanine tooth size, deep and prognathic facial skeleton, and masticatory adaptations common to members of this genus."[82]

Rather, it argued:

> "… the facial and dental proportions, postcranial anatomy consistent with human-like obligate bipedalism … , and a masticatory apparatus most similar in relative size and function to modern humans … all support assignment to the genus *Homo*—as does the inferred phylogenetic history, which includes endemic dwarfing of *H. erectus*."[83]

From their analyses, Baab and McNulty noted that the overall shape of the LB1 neurocranium showed "greatest similarities to early African/Georgian *H. erectus*."[84] See figure 3 for frontal view comparisons of the Georgian *Homo erectus*, modern human and LB1 skulls. Also, Lyras *et al*. concluded that the overall cranial morphology of LB1 was most similar to *Homo erectus*.[85]

Peter Brown, the first author of the initial *Homo floresiensis* paper, appears to have moved away from the dwarfed *Homo erectus* explanation. After examining the morphology of the LB1, LB2, and LB6 mandibles, as well as the mandibular teeth, Brown and Maeda stated, "the mandibles demonstrate that they share a distinctive suite of traits that place them outside both the *H. sapiens* and *H. erectus* ranges of variation."[86] According to them:

> "When the mandibles are considered with the existing evidence for cranial and postcranial anatomy, limb proportions, and the functional anatomy of the wrist and shoulder, they are in many respects closer to African early *Homo* or *Australopithecus* than to later *Homo*. Taken together, this evidence suggests that the ancestors of *H. floresiensis* left Africa before the evolution of *H. erectus*, as defined by the Dmanisi and East African evidence."[86]

However, a paper by Kaifu *et al*. in 2011, analyzing in detail the external morphology of the *Homo floresiensis* LB1 cranium (LB1/1), found the LB1 cranium to be "most similar to early Javanese *Homo erectus* from Sangiran and Trinil".[87] Kaifu *et al*. concluded "that the craniofacial morphology of LB1 is consistent with the hypothesis that *H. floresiensis* evolved from early Javanese *H. erectus* with dramatic island dwarfism."[87] See figure 4 for comparison of the LB1 and Sangiran 17 crania. Kaifu *et al*. later reported on the dental remains of *Homo floresiensis*, where they stated their results were consistent with the "hypothesis that *H. floresiensis* derived from an earlier Asian *Homo erectus* population and experienced substantial body and brain size dwarfism in an isolated insular setting."[88]

Congenital hypothyroidism is said to be able to "reduce brain size by approximately 50%."[89] Oxnard argues that small parent populations in terms of brain size (e.g. pygmoid crania) could have given rise to cretins with brain sizes as small as 400 cc.[90] According to Oxnard *et al*.:

> "Thus, normal South East Asian pygmoid crania of 800–1000 ml have been recorded … . On this basis, cretins from such populations could have brain sizes as small as 400–500 ml, based on scaling of height and brain size found among European endemic cretins."[91]

Published cranial capacity values for the LB1 cranium has varied (380 cc to 430 cc), with one of the more recent estimates 426 cc.[92] Hence, at least in theory, the small brain of LB1 could be explained by cretinism.

Discussion and conclusion

Opinion about *Homo floresiensis* is divided even among those who believe it is a new species. One group sees it as a dwarfed *Homo erectus*, while the other group views it as derived from an 'early' *Homo* species (like *Homo habilis*) or *Australopithecus*. Running parallel to the above debate, at least for a while, was the belief by some that *Homo floresiensis* was a pathological modern human, with the cretinism explanation favoured by me, albeit not necessarily of a modern human.

The artefacts at the Liang Bua excavation site were said to exhibit "a level of complexity previously thought to be the sole purview of *H. sapiens*."[16] It is hard to understand why evolutionists want *Homo floresiensis* recognized as

Figure 4. Right lateral views of the casts of the adult (probably female) LB1 *Homo floresiensis* cranium (right), and adult (presumed male) *Homo erectus* Sangiran 17 cranium (left) from Java, Indonesia (photo by Peter Line).

a new species of hominin, given that it does not fit the standard evolutionary story that hominid brains got larger as they increased in intelligence. According to evolutionist John Allen:

> "Taken as a whole, including both its morphology and provenance, the Hobbit fits about as well into the accepted view of hominid evolution—especially with reference to cranial capacity—as the Piltdown hoax. Piltdown was a combination of a human cranium with an ape jaw."[93]

Rather, a bone developmental pathology, in particular cretinism (a non-genetic disorder), seems more plausible. Goitre is a swelling of the neck from an enlarged thyroid gland, usually caused by dietary iodine deficiency. Iodine deficient populations in a region also increase the likelihood of cretinism in that region. There is usually a correlation between the prevalence of endemic goitre and endemic cretinism, as iodine deficiency is fundamental in the etiology of endemic cretinism, believed caused by damage to the thyroid during fetal life.[94]

Concerning goitre rates in Flores, Oxnard stated, "Today's goitre rates imply that prior hunter-gatherer populations in the hills should have been severely iodine-deficient and would regularly have produced cretins."[95] Apparently, soils nearby the Liang Bua limestone cave, where the LB1 partial skeleton was found, are "alkaline and probably therefore iodine-deficient," and along with other factors (e.g. locality of site), are said to "have precluded access to iodine-rich seafoods."[96]

Many features of cretinism appear to mimic so-called 'primitive' features of evolution, which makes it easy to make mistakes in interpretation, particularly if holding an evolutionary viewpoint. According to Oxnard:

> "It is remarkable that so many features similar to those normally present in great apes, in *Australopithecus* and *Paranthropus*, and in early *Homo* (e.g. *H. erectus* and even to some degree, *H. neanderthalensis*) but not in modern *H. sapiens* are generated in humans by growth deficits due to the absence of thyroid hormone. In other words, many of the pathological features of cretinism mimic the primitive characters of evolution making it easy to mistake pathological features for primitive characters."[97]

Postcranially, *Homo floresiensis* appears to fit with cretinism in many aspects, although not all cretins are expected to have the same features. According to Oxnard *et al.*: "cretins are enormously more variable than unaffected humans in many features (as would be expected in a pathology with different degrees of affect, and conflation with associated conditions)".[98]

Consequently, if some *Homo floresiensis* individuals were cretins, their morphological features may still have differed. It is likely that only a relatively small percentage were cretins.

There exist small-bodied people on Flores Island, Indonesia today. In a recent study, DNA analysis of 32 members of an extant human pygmy population (average height 145 cm) living on Flores, in the village of Rampasasa, near the Liang Bua Cave where *Homo floresiensis* was found, reported that: "The genomes of Flores pygmies reveal a complex history of admixture with Denisovans and Neanderthals but no evidence for gene flow with other archaic hominins," such as *Homo floresiensis* or *Homo erectus*.[99] According to Gibbons, "The team found no trace of archaic DNA that could be from the hobbit."[100] At least three DNA laboratories have attempted to obtain DNA from *Homo floresiensis*, but were unsuccessful up until August 2018.[101] Hence, as the DNA of the 'hobbit' is unknown, the above study is making the unproven evolutionary assumption that *Homo floresiensis* was a different species of human.

Maybe the reason there is no trace of the 'hobbit' in the DNA is that it never was a new or different species, but a diseased human, possibly even a pathological *Homo erectus* human. The DNA of *Homo erectus* is also unknown, but the extant human Rampasasa pygmy population have traces of the mysterious Denisovans and Neanderthals in their genome. One wonders whether the Denisovans were *erectus*-like people.

That a detailed analysis concluded that "LB1 is most similar to early Javanese *Homo erectus* from Sangiran and Trinil"[87] raises the possible scenario that *Homo floresiensis* may have been a robust type of human (e.g. *Homo erectus*) with cretinism. Another possible scenario is that 'modern' humans and *Homo erectus* interbred on Flores, and individuals like LB1 are the resultant offspring of such interbreeding, albeit with pathology. Regardless, specimens labelled *Homo erectus* and *Homo floresiensis* were descendants of Adam and Eve, and so fully human.

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What's wrong with being wrong: a closer look at evolutionary ethics—part 2

Marc Kay

Previously, I've set out the problem evolution and naturalism present for morality. In this second part, I analyze group selection, the original model that sought to explain how morality arose. Despite the majority of evolutionists having dismissed group selection as implausible, in some quarters it has made a rebound.

> "Morality is a set of psychological adaptions that allow otherwise selfish individuals to reap the benefit of cooperation." (Greene, J., *Moral Tribes: Emotion, reason, and the gap between us and them*, Atlantic Books, London, p. 185, 2015.)

Group selection—all for one, and one for all

Michael Wade defined group selection as "that process of genetic change which is caused by the differential extinction or proliferation of groups of organisms."[1] Originally proposed by Alfred Russel Wallace,[2] a collection of organisms will cooperate to gain a more secure existence against threats to the group's survival than a single organism could on its own. An individual organism will surrender its own best interests so that the probability of extinction of the group or species is minimized, though this does not necessarily exclude some gain passing to the individual. Bence Nanay has circularly addressed the quite real at-cross-purposes end product of group selection, writing that "If I do something that decreases my fitness, this can still be evolutionarily useful, as long as it increases the fitness of the group, since the fitness of the group is what counts (given that the unit of selection is the group)."[3]

The early bird doesn't always get its worm

Wynne-Edwards argued that birds' reproductive output increased until available resources were threatened. Then individuals would reduce reproductive capacity for group survival.[4] Lack, another ornithologist, disagreed, showing empirically birds were not demonstrating reproductive self-restraint. This proved the catalyst for an almost universal rejection of group selection by the early 1960s.[5] Despite bolstering his theory from a number of animal studies, particularly the red grouse, given the number of variables which affect groups and individuals, Wynne-Edwards eventually conceded that "the scale of the operation in time and space [of these variables] precludes an immediate experimental test of group selection."[6]

More importantly, Wynne-Edwards never successfully linked his animal studies and group selection to the rise of morality. He acknowledged that man can occasionally disregard concern for the group, electing for individual needs first. Notwithstanding this admission, he, without a trace of deference to the importance of providing an epistemological justification, stated moral codes are "reinforced by conscience and the law".[7] Of course this is nothing less than question begging morality into existence, additionally aided by the following conclusion:

> "There appears therefore to be no great difficulty in resolving the initial problem as to how intergroup selection can override the concurrent process of selection for individual advantage. Relatively simple genetic mechanisms can be evolved whereby the door is shut to one form of selection and open to the other, securing without conflict the maximum advantage from each."[7]

The proponents and their opposition

Most evolutionists today reject the group as the unit of selection, as it runs counter to the core principle of contemporary Darwinian theory; namely, the individual's overarching role in adaptation and survival, usually interpreted at the gene level.[8]

West *et al.* have argued that there is often a widespread, semantic confusion over what group selection truly means. They accuse some well-known academics and specialists of mistakenly conflating intergroup with intragroup selection.[9]

Ruse, in a moment of frustration, has accused group selection advocates of being "unable emotionally to face the stark nature of the Darwinian process".[10] Individuals are never going to sacrifice their fitness for the group because social behaviour always has enlightened self-interest lurking somewhere. Despite adherents' complex theoretical models, it is problematic why some group-serving feature, an initial burden for an individual carrying it, would spread to the group. Wouldn't, say, an altruistic behaviour be pounced upon as a weakness and be exploited by another who doesn't possess this particular genetic wiring? Furthermore, it has

been argued that the modelling for selection between groups has been unable to override the strong effects of selection against the spread of these altruistic traits within the group apart from some highly contrived values.[11]

Group selection advocates side-step this problem of individual egoism by splitting the selection process for cooperation at the group level from the 'more' Darwinian individual fitness maximization. Qualities that promote cooperation—honesty, providing help when needed, charity—cause groups who display them to become better survivors than ones who don't possess them. Durham believes that group and individual selection do not have to be in opposition:

> "… the acceleration of changes made possible by group-level extinction and replacement may be the key to understanding the rapid pace of the evolution of *Homo sapiens*. Once a trait like Pm [a theoretical phenotype that lies intermediately between the two extremes of minimum costs and benefits and maximum costs and benefits drawn from a hypothesized process of cultural selection] gets established by individual-level cultural selection within a social group, that trait may then give its bearers an advantage as a group in competition with other groups."[12]

Such neat independence is unrealistic and unlikely. After all, much depends on a selfish variant not being introduced into the altruists' group. If an altruistic gene can arise and spread throughout a population, why could not a selfish scoundrel just as easily pop into existence and weave his Machiavellian mischief? Before long a whole, silently plotting army of egoists would lie, cheat, pillage, plunder, and breed themselves to become the majority.[13] An initial society of altruists would become evolutionary unstable, while the egoist community would obtain stability and prove robust against external attacks.[14]

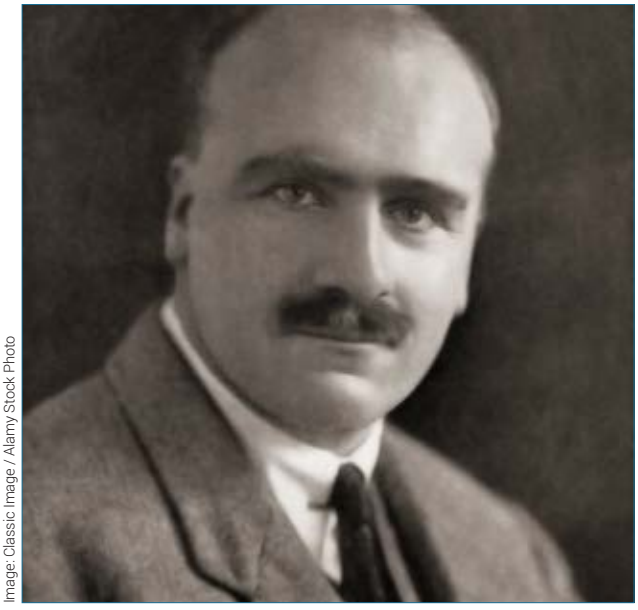

Image: Classic Image / Alamy Stock Photo

Figure 1. JBS Haldane (1892–1964) unreasonably argued that an altruistic gene could become fixed in a population if highly favourable circumstances were in force. He apparently ignored the eliminative effect of genetic drift.

On the recognition that cheats can prosper, Ayala accepts that group selection is not an evolutionary stable strategy. However, he consigns such parasitism to the non-human world, arguing instead that humans "can perceive the benefits of altruistic behaviour for the group (and through the group to themselves) and choose to behave altruistically."[15] Two comments. First, once an argument introduces 'benefits' as the *raison d'être* it would appear to be for instrumental considerations, teleological purposes and consequences other than morality. Second, similar to Hobbes, Ayala claims altruistic behaviour requires enforcement by political authority with bite. This, surely, question-begs whether the 'behaviour' in need of government authority is actually moral. Christians could point out any number of laws which, although supported by majorities, would be unquestionably called immoral. Same sex marriage, abortion, and restriction to freedom of speech, particularly limiting or even outlawing the right to criticize religions other than Christianity, quickly come to mind.

Through a series of overly imaginative thought experiments, Kitcher explains how normative capacities arose. The details are irrelevant (nothing novel to report here!); what is insightful is Kitcher's question begging that our putative evolutionary hominid relations gained sufficient altruistic tendencies. More telling is his admission that his answer is "backed by all-too-little evidence".[16]

Other explanations have been suggested to buttress group selection. These include populations dividing into small groups and being dispersed, that whole groups are frequently made extinct often through stronger groups exterminating weaker ones, and higher inbreeding rates.[17]

Haldane (figure 1) proposed that, under special conditions, an altruistic gene could possibly advance in a population if: (i) the initial gene's frequency was sufficiently high, (ii) the disadvantage of possessing the gene was low in comparison to the advantage conferred on the group, and (iii) the group split into smaller 'tribes' which facilitated the first event to come about.[18] Hamilton, a year prior to his famous Inclusive Fitness paper, criticized Haldane's group selection on the principle that novelty usually resulted in rapid disappearance:

> "[Haldane] did not, however, sufficiently emphasize that ultimately the gene number must begin to do what the gene frequency tends to do, *ex hypothesi*, from the very first; namely, to decrease to zero."[19]

Intergroup Selection, as proposed by Sewall Wright (figure 2), in which altruistic genes are spread from a small, often related, group, is premised on the viability of genetic drift being able to retain favourable characteristics, as well as severe inbreeding, leading to chance homozygosity of the

altruistic gene.[20] He theorized that large populations would break up into much smaller temporary or imperfectly isolated groups and, in these initial small groups, the gene would become fixed and the group would expand in size.[21] Once fixed in a small group, immigrants would relocate outside to another small group and the process would begin all over again. Wright argued that the groups the altruistic genes enter were also sufficiently small in population[22] to allow altruistic gene frequency to drift to high values. The 'invaded' group must be small due to the assumed initial disadvantage that an altruistic gene would have because "even a minute selective disadvantage to a gene in a population of moderate size can cause an almost deterministic reduction of the gene to a negligible frequency."[23] This three-step process of genetic drift, intrademic selection, and interdemic selection became known as the shifting balance theory.[24]

This reeks of special pleading, where the disadvantageous role of genetic drift is acknowledged but the required fitness-decreasing attribute, altruism, is still permitted to not only appear, but spread. E.O. Wilson admits that in quite small populations "drift can completely swamp out the overall effect of differential extinction within the population", yet, in the same breath, referring to Haldane's pioneering work, ignores the impact of genetic drift by claiming "the process is feasible if the groups are small enough for altruists to confer a quick advantage."[25]

As Remine and others have pointed out, small populations work against a beneficial gene mutation being fixed as they are rarer and can be rapidly removed by chance.[26] Well understood, drift tends to eliminate novelty rather than preserving it, and Wright gave unreasonably high values to their retention in the outside groups.[27] Williams noted how Simpson severely criticized Wright by identifying the "rather improbable concatenation of the population parameters of size, number, degree of isolation, and the balance of genic and group selection coefficients."[28]

The model's success also depended on overcoming a small population's greater tendency to head towards extinction more readily than larger ones. Williams, the key influence behind Dawkins' push for the gene as the unit of selection, claimed such a process to be virtually impossible, labelling it 'misinterpretation [and] impotent' and going on to say "group related adaptations do not, in fact, exist."[29] While begging the question of an individual gene for self-sacrifice initially coming into existence, Williams objected to the contrived circumstances of the model. Not only would a highly disadvantaged individual have to survive its parlous environment, it would have to migrate to another group where altruistic tendencies were not disadvantageous, and then migrate back to form its own group of like-minded altruists. All this would unravel at a fillip if a selfish mutant were to appear among them.

Sober and Wilson demur, however.[30] Take a group of, say, 200 individuals containing a very small percentage of self-sacrificing helpers. After a few generations the ratio of non-helpers to helpers would increase, eventually leading to the complete extinction of helpfulness. But, argue Sober and Wilson, something very interesting happens if this original 200 is evenly split into two isolated groups, one containing only non-helpers, the other holding the same number of helpers as the original thought experiment. After a few generations, the ratio of helpers to non-helpers will fall within the second group, but, relative to the global population, the ratio actually increases. After several generations, mirroring the outcome of the initial calculations, the helpers of the second group would also become extinct. However, consider what would occur if a 'special' event allowed the two groups to recombine, say, after the third generation. If this new mega-group were proportionally culled back to the original 200 and divided into the two disparate groups of exclusively non-helpers and a mixed population, the latter would start reproduction from a greater ratio base of helpers to non-helpers than the original. Furthermore, if the members were allowed to associate with whomever they preferred (i.e. helpers attracting like-minded souls), reiteration of the splitting and recombination process would slowly, but inexorably, increase the percentage of helpers to non-helpers.

Now, what would happen if the whole scenario began again, but with a reversal of percentages of helpers to non-helpers and allowed to reproduce for a similar tally of generations? If the first group were all helpers and the second contained a minority of non-helpers, eventually the latter's non-helping numbers would increase but then decrease relative to the global population of actors. Splitting and recombining the groups would lead to the non-helpers' extinction.[31]

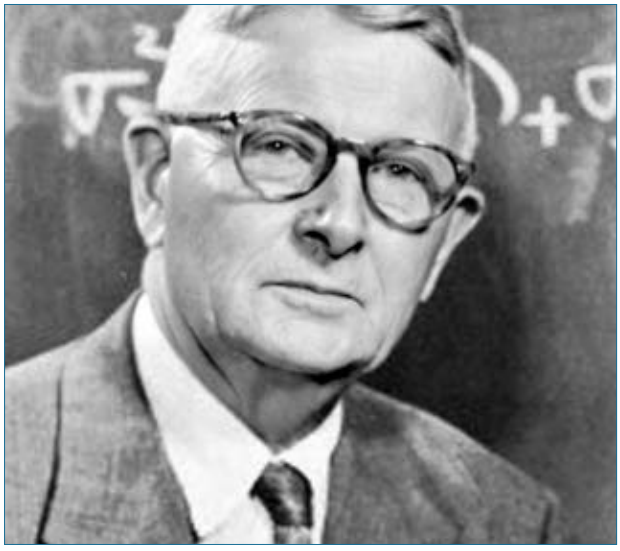

Figure 2. Sewall Wright theorized that genetic drift would randomly and favourably allow altruistic alleles to become dominant within a group. This group would subsequently split and an altruistic individual would enter another non-altruistic group and somehow proliferate. Proponents of intergroup selection argue a saint immigrating to a population of immoral individuals can, over time, replace the maleficent group.

Richard Joyce, in response, called this 'number fiddling',[32] while others have raised doubts regarding the methodological impracticalities of undertaking the tremendous amount of empirical research to ascertain whether group selection really occurs, whether a population does actually hold distinct subsets and whether or not these clusters exhibit a genetic-based variance in fitness.[33]

The phoenix returns

A recent paper has, however, advocated a re-evaluation of group selection. E.O. Wilson and David Sloan Wilson have sought to dispel the, as they see it, original confusion surrounding its rejection.[34] Responding to Williams', Dawkins', and others' efforts to remove the group as a significant evolutionary force, they have argued that its detractors' fundamental objections—theoretical implausibility, lack of empirical evidence, and more robust alternative explanations—are no longer sustainable. They cite the 'behaviour' of microbial organisms, highly contrived cultures of bacteria and phage being directed by a 'prespecified migration scheme', and artificial selection of groups of plants rather than individuals, to counter Williams *et al.*'s contention that selection is not operating at the group level.[35]

Ignore the problems raised against group selection but recall evolutionists' ultimate objective: the group was fancied a rudimentary antecedent to human altruism. Conceding that original naïve group-only selection lacked proof, the Wilsons attempt to salvage their theory by claiming that the appearance and spread of altruism happens instead on a multilevel basis. Rather than selection occurring exclusively on one level, fitness differences can occur on all levels, within a 'nested hierarchy' of units. Altruism arises through genes and individuals within a group, and then extends beyond the borders of a single group to acting between groups. Acknowledging that overcoming altruism's selective disadvantage within a group is the core problem, the authors nevertheless argue that if this

> "… trait is locally disadvantageous wherever it occurs, then the only way for it to evolve in the total population is for it to be advantageous at a larger scale. Groups whose members act 'for the good of the group' must contribute more to the total gene pool than groups whose members act otherwise. This is the only solution to the problem from an accounting standpoint, which is why the basic logic of multilevel selection is present in all theoretical frameworks."[36]

E.O. Wilson has continued to carry the flag for multi-level selection:

> "… the unit of heredity is the gene, which typically acts as part of a network of genes, and the target of natural selection is the trait prescribed by the gene … . A gene for a trait that affects a group member's longevity and reproduction relative to other members in the same group is said to be subject to individual-level natural selection. A gene for a trait entailing cooperation and other forces of interaction with fellow group members may or may not be subject to individual-level selection. In either case it is also likely to affect longevity and reproduction of the group as a whole. Because groups compete with other groups, in both conflict and their relative efficiency in resource extraction, their differing traits are subject to natural selection. In particular, the genes prescribing interactive (hence social) traits are subject to group-level selection."[37]

With such malleability, it remains unpersuasive that there is a single rational justification, short of highly contrived mathematical modelling, for their claim that group selection is a major factor.[38]

Equally astonishing is their confidence in meretricious and 'just so' stories that amount to nothing more than special pleading. Altruism arose because groups became level playing fields, which allowed social equality and fairness to extend to other groups:

> "A key event in early human evolution was a form of guarded egalitarianism [which suppressed] fitness differences within groups [and] made it possible for between-group selection to become a powerful evolutionary force … . The human major transition was a rare event, but once accomplished, our ability to function as team players in coordinated groups enabled our species to achieve worldwide dominance."[39]

Evolution is principled upon differential survival, yet here are two evolutionists implying that differential survival suppresses differential survival—a howler which, no doubt, would have Popper turn in his grave!

Tautology and special pleading permeate the literature. For example, two authors pleonastically and circularly explain group selection's possibility by proposing that "differential extinction of groups can account for the direction of evolutionary change in a trait only when groups differ in the

Image: Shah Jahan / Wikimedia, CC BY 3.0

Figure 3. Arabian babbler (*Argya squamiceps*). A bird, giving out a distress call to alert the flock of a nearby predatory threat, and thus putting its own existence at risk, is a standard example to demonstrate group-selection altruism. However, doubts have arisen over this explanation. One hypothesis is that sentinels may be warning the predator it's been spotted for the bird's own survival, not primarily for the group.

trait and when this difference accounts for the difference in extinction rate."[40]

Likewise, special pleading. Consider a recent paper in which its authors conveniently argue:

> "The paradox in the evolution of altruism is that carriers that are, on average, at a local disadvantage (i.e. compared to those they interact with) can still have higher fitness than the population average and hence can increase overall. The most fundamental explanation for how altruism (defined by local interactions) increases in a population requires that there be assortments in the population such that the benefit from others falls sufficiently often to carriers (and at the same time non-altruists are stuck interacting more with each other)."[41]

Bowles lays out several counterfactuals against the possibility of altruism arising through group selection but sets these data aside and claims that early humans acquired culturally transmitted norms, like monogamy and consensus decision-making. These, he argues, "reduced within-group differences in fitness [which] may have attenuated the selective pressures to which altruists are subject."[42] For support, he includes a dazzling array of charts, graphs, and intricate equations. In a rare moment of transparency, he concludes that the "above estimates are subject to substantial error given that they are inferences about conditions occurring tens of thousands of years ago for which very little direct evidence is available."[43]

As noted by Williams, *mutatis mutandis*, any behavioural trait could be explained through the fallacy of 'evolutionary plasticity'. He astutely observed that "a biologist can make any evolutionary speculation seem scientifically acceptable merely by adorning his arguments with the forms and symbols of the theory of natural selection."[44]

Conclusion

Something important has been lost in this forest of dispute. Whether one sees merit or places no value in the group selection argument, everything rests on having an actual gene(s), or a proxy mechanism, for altruism. No one has demonstrated this, its reality only presupposed. The considerable disagreement among evolutionists and the paucity of evidence for deriving altruism through group selection should give creationists confidence that morality is a unique attribute of human existence, remaining inexplicable through group selection specifically and, more generally, within a materialist worldview.[45]

In the next part I will discuss several other proposed evolutionary explanations for the rise of morality. These, like group selection, fare no better.

References

1. Wade, M.J., A Critical review of the models of group selection, *The Quarterly Review of Biology* **53**(2):101, Jun 1978.
2. There is some disagreement concerning the accuracy of this. Ruse, without explanation, comments that Wallace favoured group selection. (Ruse, M., *Taking Darwin Seriously: A naturalistic approach to philosophy*, Basil Blackwell, Oxford, p. 48, 1986.) However, for a more detailed exploration and contrary position, see Bulmer, M., The theory of natural selection of Alfred Russel Wallace, *Notes and Records of the Royal Society of London* **59**(2):125–136, May 2005. From the following passages I would think it reasonably clear Darwin himself held to some group dynamic: "For *firstly*, the social instincts lead an animal to take pleasure in the society of its fellows, to feel a certain amount of sympathy with them, and to perform various services for them" (Darwin, C., *The Descent of Man, and Selection in Relation to Sex*, Penguin Books, London, p. 121, 2004). See also his discussion about the individual acting for the 'general good' on pp. 144 ff. Also note the following: "as happiness is an essential part of the general good, the greatest happiness principle indirectly serves as a nearly safe standard of right and wrong" (*Ibid*., Darwin, p. 681). From these remarks you can certainly appreciate the impact that utilitarianism had on Darwin's normative values. See also ref. 8, below. Robert Richards has claimed that Darwin's views on group selection strengthened over time and that later editions of the *Origin* were more forceful in promoting the explanation. See Richards, R., Darwin on mind, morals and emotions; in: Hodge, J. and Radick, G. (Eds.), *The Cambridge Companion to Darwin*, Cambridge University Press, Cambridge, pp. 103, 114, n. 37, 2003. Korsgaard alludes to an even earlier suggestion of the group being hierarchically superior. She writes, "Hobbes and Pufendorf believed that the content of morality is given by natural reason. What morality demands of us is what it is reasonable for us, at least as a group, to do" (Korsgaard, C.M., *The Sources of Normativity*, Cambridge University Press, Cambridge, p. 27, 2009). Some caution is due, however. Both of these early modern philosophers took moral impetus to lie in some sort of divine command: "They believed that it *takes* God or a Godlike sovereign to impose moral properties on the indifferent world of nature" (Korsgaard, p. 22).
3. Nanay, B., Group selection and our obsession with the meaning of life, *The Monist* **93**(1):76–95, Jan 2010; p. 80.
4. For a full elaboration of Wynne-Edwards' theory, see his article: Intergroup selection in the evolution of social systems, *Nature* **200**(4907):623–626, 1963. A quite useful summary of Wynne-Edwards' life and work can be read at encyclopedia.com/doc/1G2-2830906226.html, accessed 20 Aug 2021.
5. See Ridley, M., *The Origins of Virtue*, Softback Preview, England, pp. 175–176, 1997; Wynne-Edwards, ref. 4. The idea was also attacked in Williams, G., *Adaptation and Natural Selection: A critique of some current evolutionary thought*, Princeton University Press, Princeton, p. 103 ff, 1966. For a humorous sketch of Haldane lampooning Wynne-Edwards' group selection to Maynard Smith, see Kohn, M., *A Reason for Everything: Natural selection and the English imagination*, Faber and Faber, London, pp. 227–228, 2005.
6. Wynne-Edwards, ref. 4, p. 625.
7. Wynne-Edwards, ref. 4, p. 626.
8. Darwin, however, did allude to group selection in his discussion of the 'probable' steps that were involved in transforming a selfish tribe to a more altruistic one. He wrote, "It must not be forgotten that although a high standard of morality gives but a slight or no advantage to each individual man and his children over the other men of the same tribe, yet that an increase in the number of well-endowed men and an advancement in the standard of morality will certainly give an immense advantage to one tribe over another" (Darwin, ref. 2, p. 157).
9. West, S.A., Griffin, A.S., and Gardner, A., Social semantics: altruism, cooperation, mutualism, strong reciprocity and group selection, *J. Evolutionary Biology* **20**(2):415–432, Mar 2007. Elliott Sober maintains, however, Darwin was a pluralist with respect to selection and on some matters supported the group as a vehicle for evolution of a trait. See Sober, E., The ABCs of altruism; in: Post, S.G., Underwood, L.G., Schloss, J.P., and Hurlbut, W.B. (Eds.), *Altruism and Altruistic Love: Science, philosophy and religion in dialogue*, Oxford University Press, New York, p. 18, 2002.
10. Ruse, M., A Darwinian naturalist's perspective on altruism; in: Post *et al.* (Eds.), ref. 9, p. 154.
11. For such and other difficulties of group selection, see Brandon, R.N. and Burian, R.M., *Genes, Organisms, Populations: Controversies over the units of selection*, Bradford Books/MIT Press, Cambridge, MA, 1984. For arguments for its existence, see Sober, E. and Wilson, D.S., *Unto Others: The evolution and psychology of unselfish behavior*, Harvard University Press, Cambridge, MA, 1998.
12. Durham, W.H., Toward a coevolutionary theory of human biology and culture; in: Caplan, A.L. (Ed.), *The Sociobiology Debate*, Harper & Row, New York, p. 440, 1978. Also see morality being introduced via group selection due to its being 'sexy' in Miller, G., Kindness, fidelity, and other sexually selected virtues; in: Sinnott-Armstrong, W. (Ed.), *Moral Psychology, vol. 1, The Evolution of Morality: Adaptions and innateness*, The MIT Press, Cambridge, MS, pp. 209–243, 2008. For germane criticisms of this application of group selection, see Driscoll, C., Why moral virtues are probably not sexual adaptions; in: Sinnott-Armstrong, pp. 245–250. Retrospective explanations often incorporate 'bait-and-switch'. For example, Richard Alexander, twice over, employs words

which more or less signal the same idea but utilizes them to appear as though they are performing two separate functions. He writes, "once groups form, social behaviour evolves within them for three reasons: First, it may enhance the original advantage of group living" (Alexander, R.D., The evolution of social behaviour, *Annual Review of Ecology and Systematics* **5**:325–383, 1974; pp. 329). Surely it would be inconceivable, on the level of an oxymoron, to have a group without social behaviour. Is it at all possible to be a member of a group but display absolutely no evidence of the latter? Groups can, and only can, be understood to be a synonym for social behaviour. Social behaviour doesn't come into being (in his words, 'evolve') after groups form but exists from the beginning. Evolutionists cannot argue otherwise because they would be faced with the bigger problem of explaining what would appear to be either a teleological phenomenon or something so complex as social behaviour 'popping' into existence without a cause.

13. Or, as Robert Frank points out, group goals can be avoided due to the absence of around-the-clock detection: "[There are people] whose strategy is to follow all group norms except those that are manifestly impractical to enforce. Such a person would not tip at restaurants away from home, or make anonymous donations to charity, or vote; nor would he return a lost wallet found on a street corner. But where convenience dictated he would pour pesticide down his basement drain or toss litter on a deserted beach" (Frank, R.H., Honesty as an evolutionarily stable strategy, *Behavioral and Brain Sciences* **12**(4):705–706, Dec 1989). Notwithstanding his cavil, Frank, however, remains committed to an evolutionarily stable strategy by supposing, rather naively I contend, cheats can be quickly discovered by, among other things, their body language belying their (fake) honesty and cooperation.

14. Of all academic disciplines, it would not be entirely unfair to implicate philosophy as being quixotic. It's been argued that if it were discovered that morality was not so moral after all, that evolutionary considerations and empiricism dragged us screaming and kicking to a conclusion that some of our deliberations were motivated by entirely selfish reasons, this would not constitute reason to reject all moral judgements based on a similar origin. The philosopher Hallvard Lillehammer is committed to retaining moral judgements despite a finding just such as this. He justifies his position by stating, "while the discovery that what appeared to be an instance of altruism is really selfishness in disguise might be depressing, the possibility remains that we would on reflection prefer the appearance of altruistic acts over blatantly selfish behaviour" (Lillehammer, H., Debunking morality: evolutionary naturalism and moral error theory, *Biology and Philosophy* **18**(4):573, Sep 2003). The lengths people go to in order to justify an incredibly bad idea never cease to amaze. I'm quite sure, for people living in the real world, the speedy identification of a narcissistic sociopath is a valued enterprise. I don't want to be fooled by faux-good works but to quickly discern the selfish so as to avoid or protect those that are unable to look after themselves.

15. Ayala, F., Biology to ethics: an evolutionist's view of human nature; in: Boniolo, G. and De Anna, G. (Eds.), *Evolutionary Ethics and Contemporary Biology*, Cambridge University Press, Cambridge, p. 152, 2006.

16. Kitcher, P., Between fragile altruism and morality: evolution and the emergence of normative guidance: in: Boniolo and De Anna (Eds.), ref. 15, p. 170.

17. Although he stands firm that group selection remains a viable alternative, Michael Wade's paper examines several of its problems. See Wade, M., ref. 1, pp. 101–114. Wade's paper is useful for identifying the 'realistic' (read, tendentious) assumptions that proponents of group selection filter through to their models. Also see Wispé, L. (Ed.), *Altruism, Sympathy, and Helping: Psychological and sociological principles*, Academic Press, New York, p. 50, 1978, and Wilson, E.O., *Sociobiology: The New Synthesis*, The Belknap Press of Harvard University Press, Cambridge, MA, chap. 5, 2000, Wilson is one of the most quoted and respected of evolutionary scientists, though not in equal measure. He's particularly referred to concerning his study of insects and deliberations on the 'history' of moral behaviour. In his concluding comments to this chapter, Wilson quite astutely recognizes that science and religion should not be divorced from each other. And it is to this end that he suggests "a science of sociobiology, if coupled with neurophysiology, might transform the insights of ancient religions into a precise account of the evolutionary origin of ethics" (p. 191). Unfortunately, his preferred text is the *Bhagavad Gita*, in particular a splice from the dialogue between Arjuna and the Indian god Krishna, to link the "conduct of termite colonies and turkey brotherhoods to the social behaviour of man."

18. Haldane, J.B.S., *The Causes of Evolution*, Longmans Green & Co., London, p. 235, 1932. As to the intellectual honesty of assuming an altruistic gene's high frequency, an anonymous reviewer has helpfully expanded on how this fanciful solution plays out in an evolutionary mindset. I quote his comment in full: "They assume a particular gene starts out being initially neutral, and 'drifts' its way to 'sufficiently high frequencies'—and then a 'change' happens (say, due to a change in the environment), and this neutral gene becomes 'beneficial', and then begins its substitution process already at a high frequency. The big problem is that they ignore the bad side effects of their own story. Environmental change is random with respect to genes, and random change is overwhelmingly harmful, not beneficial. In other words, the neutral gene will almost always be turned into harmful, and this process will overwhelm their storytelling. Evolutionists cannot be allowed to 'select' the mechanism they like and ignore the ones they don't like. They must take nature as it is." I thank this reviewer for his insight.

19. Hamilton, W.D., The Evolution of Altruistic Behavior, *The American Naturalist* **97**(896):354, Sep–Oct 1963.

20. ReMine neatly outlines the reasons that evolutionists propose small populations, opt for the bean-bag approach to trait accumulation and ignore the importance of polygeny. These unrealistic assumptions tendentiously serve to theoretically overcome the awkward and insurmountable problem of inadequate reproduction rate of the higher vertebrates. See Remine W.J., *The Biotic Message: Evolution versus message theory*, St Paul Science, Saint Paul, MN, pp. 193–194, 1993.

21. Wright's concepts concerning population structure came from cattle breeding in which a farmer would artificially inbreed his animals and then cross-breed them with another group. As remarked by Provine, Wright's belief that animal husbandry was applicable to nature was "based upon very little evidence". Provine, W.B., *Sewall Wright and Evolutionary Biology*, The University of Chicago Press, Chicago, IL, p. 236, 1986. Wright also observed highly inbred populations of guinea pigs, which led him to conclude that very small, isolated populations led to deleterious fitness and extinction.

22. Confusingly, E.O. Wilson writes, "[altruistic] genes can prevail over all the metapopulation if the populations they [the altruistic genes] aid are small enough to allow them to drift to high values" (Wilson, ref. 17, p. 109); whereas W.C. Allee writes, "Wright and others have evidence that evolution proceeds most rapidly in populations of interbreeding organisms that are intermediate in size, as compared with similar populations which are over-small or over-large" (Allee, W.C., Where angels fear to tread: a contribution from general sociology to human ethics; in: Caplan (Ed.), ref. 12, p. 44). Williams points out that Wynne-Edwards postulated that smelts, in groups of tens of thousands of individuals, and marine invertebrates, in their millions, may be the origin of biotic adaptations, despite individuals carrying a disadvantage. (Wynne-Edwards, V.C., *Animal Dispersion in Relation to Social Behaviour*, Oliver & Boyd, Edinburgh & London, 1962. Quoted in: Williams, ref. 5, p. 113.) Also note Fisher's opposition to the importance of drift because he regarded the fixation of low frequency mutations more likely in larger populations because they were more often going to occur compared to small populations. For a discussion, see Provine, ref. 21, p. 239 ff. All I can say is, go figure!

23. Williams, ref. 5, p. 113. Wright admitted, however, that the population cannot be too small as drift would lead inevitably to "loss of variance, and degeneration" (Wright, S., The genetical theory of natural selection: a review, *J. Heredity* **21**(8):354, Aug 1930, pp. 349–356).

24. For two worthwhile discussions on this, see Provine, ref. 21, pp. 285 ff, and Remine's thoroughly subversive review of the theory, ref. 20, pp. 190–192.

25. Wilson, E.O., The Genetic Evolution of Altruism; in: Wispé (Ed.), ref. 18, p. 16.

26. ReMine, W.J., ref. 20, p. 181. Also see Sanford, J.C., *Genetic Entropy & the Mystery of the Genome*, FMS Publications, Waterloo, NY, pp. 76 and *passim*, 2005. For further explanation on the failure of drift, see Tomkins, J.P. and Bergman, J., Neutral Model, genetic drift and the Third Way—a synopsis of the self-inflicted demise of the evolutionary paradigm, *J. Creation* **31**(3):94–102, 2017; creation.com/evolutionary-mechanisms.

27. See Wright, S., *Evolution and the Genetics of Populations, vol. 2: Theory of Gene Frequencies*, The University of Chicago Press, Chicago, IL, 1969. Also see Wilson, ref. 17, p. 166.

28. Williams, ref. 5, p. 112.

29. Williams, ref. 5, pp. 8, 93. Williams, however, along with Bill Hamilton (the originator of Kin Selection, another model to explain the rise of morality, which is to be examined in a subsequent part), later in life did somewhat ameliorate his views on group selection. As explained by Samir Okasha, both "did come to accept elements of a 'hierarchical' [i.e. multi-level] approach, though without rescinding their commitment to gene's eye thinking" (Okasha, S. and Maynard Smith, J., On the levels of selection question, *Biology and Philosophy* **20**(5):997, Nov 2005). For more detail on the modification of their views, see Okasha, pp. 997 ff. It must be kept in mind that Okasha is pro–group selection, believing, somehow, for example, the prokaryote to eukaryote transition is best explained by a group selection mechanism.

30. Sober and Wilson, ref. 11. Lest I misrepresent these two as idealistic, ivory tower, dyed-in-the-wool group selectionists, they comment that this mode of selection is not all as rosy as it appears: "[Group selection] provides a context in which hurting individuals in other groups can be selectively advantageous. Group selection favors within-group niceness and between-group nastiness" (p. 9). Also note Sober and Wilson's earlier paper, with additional comments from opponents and detractors; in: Reintroducing group selection to the human behavioral sciences, *Behavioral and Brain Sciences* **17**(4):585–654, Dec 1994. For another of Sober's mathematical, tendentious, assumption-filled explanations, see his *From a Biological Point of View: Essays in evolutionary philosophy*, Cambridge University Press, Cambridge, pp. 10–13, 1994.

31. Responding to Sober and Wilson's attempt to place group selection back on the table, Randolph Nesse notes the attractiveness of their project and the demon in the alternative: "W[ilson] & S[ober] seem determined to demonstrate that human altruism arises from group selection. I sympathize with their wish. The discovery that tendencies to altruism are shaped by benefits to genes is one of the most disturbing in the history of science. When I first grasped it, I slept badly for many nights, trying to find some alternative that did not so roughly challenge my sense of good and evil. Understanding this discovery can undermine commitment to morality—it seems silly to restrain oneself if moral behavior is just another strategy for advancing the interests of one's genes. Some students, I am embarrassed to say, have left my courses with a naive notion of the selfish gene theory that seemed to them to justify selfish behavior, despite my best efforts to explain the naturalistic fallacy [*sic*]. Is selfish-gene theory a meme that is toxic to social structures that depend on commitment to abstract moral principles? I worry a lot about this possibility and thus sympathize with those who want to show that human altruism was shaped by group selection. If this were true, it would help, psychologically at least, to reconcile our moral feelings with our biological natures. Unfortunately, it seems to be false" (Nesse, R., Why is group selection such a problem? *Behavioral and Brain Sciences* **17**(4):633–634, Dec 1994).
32. Joyce, R., *The Evolution of Morality*, The MIT Press, Cambridge, MA, p. 37, 2007. As a result of this seemingly tendentious numbers game, Joyce remains ambivalent whether altruism was an outcome of group selection. However, "what is important is that helping behaviours have been selected for" (p. 38). Note the circularity: helping behaviours exist; evolution is the only explanatory game in town; it doesn't matter if group selection is what really happened as long as we can provide a model because we know that evolution must have caused helping behaviours to arise. For a fuller account of Sober and Wilson's model, see Joyce, pp. 33–40. Abstract thought experiments notwithstanding, Jane Goodall observed prolific cannibalism within a group initiated by a high-ranking female and one of her daughters, and a four-year war of extermination when a group of chimps divided. Despite the smaller one still remaining within the original territory, the larger one 'annihilated' the former (Goodall, J., *Reason for Hope: A spiritual journey*, Thorsons, London, pp. 113–117, 1999).
33. It's been argued that the selection debate has been influenced by one's worldview. On the background debate, see Shavit, A., Shifting values partly explain the debate over group selection, *Studies in History and Philosophy of Biological and Biomedical Sciences* **35**(4):698 ff, Dec 2004. Some hint of the elusiveness of nailing down a tight definition of 'group' is revealed in Shavit's labelling of it as a 'metaphor' (p. 700). Shavit's paper is one of the most riveting and controversial papers I've read. This well-documented argument is that political allegiances influenced people's ideas on what selection process they supported. For example, she writes that "during World War II many Anglo-American scientists associated group selection with fascist ideologies, and individual selection with democracy and freedom" (p. 704). For an equally fascinating paper on the politics behind the man and his theory, see Shapiro, A.M., Haldane, J.B.S., Marxism, and the conduct of research, *The Quarterly Review of Biology* **68**(1):69–77, Mar 1993.
34. Wilson, D.S. and Wilson, E.O., Rethinking the theoretical foundation of sociobiology, *The Quarterly Review of Biology* **82**(4):327–348, Dec 2007.
35. Wilson and Wilson, ref. 34, pp. 333–334. For references which point out and address the basic errors in the Wilsons' confusion, particularly with respect to their proposed counter-examples, see West, S.A., Griffin, A.S., and Gardner, A., Social semantics: altruism, cooperation, mutualism, strong reciprocity and group selection, *J. Evolutionary Biology* **20**(2):424, 2007. Also note the host of problems brought about by differences in definitions of groups and the abstract and broad nature of such, semantics, heuristic values etc. in Shavit, A. and Millstein, R.L., Group selection is dead! long live group selection, *BioScience* **58**(7):574–575, Jul/Aug 2008.
36. Wilson and Wilson, ref. 34, p. 338.
37. Wilson, E.O., *The Meaning of Human Existence*, Liveright Publishing Corporation, New York, pp. 62–63, 2014.
38. Apparently oblivious to the binding force of the Law of Non-Contradiction, David Wilson confidently proposed that "traits that benefit whole groups can spread only by causing groups possessing the trait to out-produce other groups. If these traits are also disadvantageous within groups (i.e. they are altruistic), then the process of group selection must be correspondingly strong" (Wilson, D.S., A critique of R.D. Alexander's views on group selection, *Biology and Philosophy* **14**(3):437, Jul 1999). Samir Okasha points out that a part of the disagreement regarding group-only selection centred upon the definition of a group. Wilson, along with Elliott Sober, took an entirely different direction to Maynard Smith on what exactly constitutes a group. See Okasha, S., ref. 29.
39. Wilson and Wilson, ref. 34, p. 343. More recently, E.O. Wilson has continued his highly idealistic having-his-cake-and-eating-it-too multilevel selection explanation: "the key to the mystery is the force that lifted prehuman social behaviour to the human level. The leading candidate is multilevel selection, by which hereditary social behaviour improves the competitive ability not just of individuals within groups but among groups as a whole … during organic evolution the unit of natural selection is not the individual organism or the group, as some popular writers have misconstrued … . The target of natural selection is the trait prescribed by the gene. The trait can be individual in nature and selected in competition among individuals inside or outside the group. Or the trait can be socially interactive in nature with other members of the group (as in communication and cooperation) and selected by competition among groups. A group of uncooperative, poorly communicating individuals will lose to its better organized competitors … multilevel selection, with a powerful role of group-to-group competition, has been a major force in the forging of advanced social behaviour" (Wilson, ref. 37, pp. 28–29). Wilson also seems oblivious to the internal contradiction generated by group selection. He writes that "Within groups selfish individuals beat altruistic individuals, but groups of altruists beat groups of selfish individuals. Or, risking oversimplification, individual selection promoted sin, while group selection promoted virtue" (Wilson, ref. 37, p. 33). The former's altruism in and of itself cannot beat selfish groups in an altruistic manner. If groups of altruists win out over groups of selfish individuals then they must do so by being selfish toward the selfish group. In any case, the plausibility of Wilson's argument does rest on an oversimplification: no group, and certainly no individual, is purely altruistic.
40. Alexander, R.D. and Borgia, G., Group selection, altruism, and the levels of organization of life, *Annual Review of Ecology and Systematics* **9**:450, 1978.
41. Fletcher, J.A. and Doebeli, M., How altruism evolves: assortment and synergy, *J. Evolutionary Biology* **19**(5):1389, Sep 2006.
42. Bowles, S., Group competition, reproductive leveling, and the evolution of human altruism, *Science* **314**(5805):1569, Dec 2006.
43. Bowles, ref. 42, p. 1572.
44. Williams, ref. 5, p. 21. No more perspicuous example is to be found than in Nanay's paper. He writes, "our [contemporary] evolutionarily fixed psychological disposition to look for the meaning of life is an extension of our evolutionary fixed psychological disposition to be part of an isolated [Pleistocene] group, [and] then taking the meaning of life to derive from some larger [contemporary] group one is part of is a natural way of satisfying this disposition" (Nanay, ref. 3, pp. 76–95). Certain that our putative Pleistocene ancestors were, for example, addicted to sugar, and that this was then adaptive, but clearly not so now, Nanay distinguishes himself by supporting these claims with the following: "we do not have any direct evidence of what [this environmental adaptedness] looked like, but some of its characteristics can be *postulated* [my italics] based on what we know about how our ancestors lived in the Pleistocene era" (p. 86).
45. I haven't included an important counterfactual to group selection; namely, the phenomenon of infanticide. For a brief, and referenced, analysis of this, see Parmigiani, S., De Anna, G., Mainardi, D., and Palanza, P., The biology of human ethics: an evolutionary perspective; in: Boniolo, G. and De Anna, G. (Eds.), ref. 15, pp. 129 ff. Social Darwinism, the biological parent's black sheep sibling, has its group selectionist adherents. The uber-capitalist Andrew Carnegie, disciple and friend of Spencer, wrote that the biological foundations of the law of competition "cannot [be] evade[d; there are] no substitutes for it; and while the law may sometimes be hard for the individual, it is best for the race, because it insures the survival of the fittest in every department" (Carnegie, A., Wealth, *North American Review* **148**(391):653–664, Jun1889; pp. 655). Mark Francis, despite Carnegie's enthusiasm for Spencer, argues that "Spencer's progressive evolutionary theory has been widely misunderstood as a hard-hearted apology for business" (Francis, M., *Herbert Spencer and the Invention of Modern Life*, Acumen, Stocksfield, UK, p. 278, 2007). Whatever the merits of Francis's arguments are, it is difficult to see how this can be reconciled with Spencer's clear dislike for social welfare. It is quite possible that the two can be quite happy bedfellows but, ostensibly at least, there appears to be some tension.

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What's wrong with being wrong: a closer look at evolutionary ethics—part 3

Marc Kay

In part 1, I underscored the difficulty of explaining how something so intangible as ethics could arise through the material process of evolution. Furthermore, altruism is at cross purposes with the selfish reproductive drive of evolution, getting "more of me" into subsequent generations. Part 2 underscored the failure of group selection, Darwin's original theory of altruistic behaviour. Part 3 will look at another evolutionary explanation for the rise of morality and altruism, kin selection, and some of the insurmountable difficulties which emerge.

Kin selection: blood is genetically thicker than water

With a frankness seldom found, W.D. Hamilton, who set out the foundation for a full theory of kin selection (figure 1),[1] noted:

> "With very few exceptions, the only parts of the theory of natural selection which have been supported by mathematical models admit no possibility of the evolution of any characters which are on average to the disadvantage of the individuals possessing them. If natural selection followed the classical models exclusively, species would not show any behaviour more positively social than the coming together of the sexes and parental care."[2]

Thus, the problem of altruism crystallizes: how is this type of behaviour, which appears to have a detrimental impact upon an individual's survival and reproductive capacity, fixed and spread in a population?

To solve the problem of this working-against-one's-own-interest behaviour, Hamilton proposed the idea of 'inclusive fitness'.[3] He argued that one's own fitness is not solely a function of how successfully you aid your genetically proximate individuals, like your immediate offspring. Under certain conditions less propinquitous relatives may serve your ultimate reproductive interests. Hamilton's lengthy mathematical modelling calculated that these disadvantageous acts must, on average and in proportion to their genetic relatedness, benefit an individual's siblings and relatives more than they benefit the individual. In a strictly genetically deterministic world,[4] Hamilton claimed, however, that "we expect to find that no one is prepared to sacrifice his life for any single person but that everyone will sacrifice it when he can thereby save more than two brothers, or four half-brothers, or eight first cousins."[5] In other words, for actions between kin to be considered altruistic and to be selected for, "the ratio of the recipient's gain to the altruist's loss [must be] greater than the reciprocal of the degree of relatedness between them [figure 2]."[6] So, for two siblings having on average 50% of their genes in common, if there is "a tendency for altruistic behaviour [to occur in] any particular gene, that gene would increase in frequency when the cost to the altruistic sib is less than one half the benefit to the other sib."[7]

This theory was regarded by its advocates as a major leap forward for an evolutionary explanation of psychological altruism. No recipient relative outwardly pays back the donor, and no donor is actually in search of an outward reward, so it has the form of genuine altruism. The incentive to do 'good' lies hidden in the altruist's genes' drive to survive better than if aid wasn't provided to members of the extended family. Sacrificing one's own interests by promoting the fitness of related others ensures that your genes, with varying degrees of correspondence, will spread and thus be better represented in the broader gene pool.

Obviously, there is no coefficient abacus inside the gene calculating the maths for cost benefit and genetic relatedness. It is sufficient "an animal be pre-programmed in such a way that it behaves as if it had made a complicated calculation."[8] Notwithstanding his genetically determined world seemingly reified by his mathematical modelling, the heuristic value of Hamilton's calculus doesn't rise to any great height due to its not being able to reflect real world structure:

> "The conventional parameters of population genetics, allele frequencies, mutation rates, epistasis, migration, group size, and so forth, are mostly omitted from the equations. As a result, Hamilton's mode of reasoning can be only loosely coupled with the remainder of genetic theory, and the number of predictions it can make is unnecessarily limited."[9]

The convenient reduction of one novel, altruistic-tending phenomenon to a single fortuitous mutation is routine in evolutionary explanations for social behaviour. Hamilton employed this throughout his kin selection account. In his

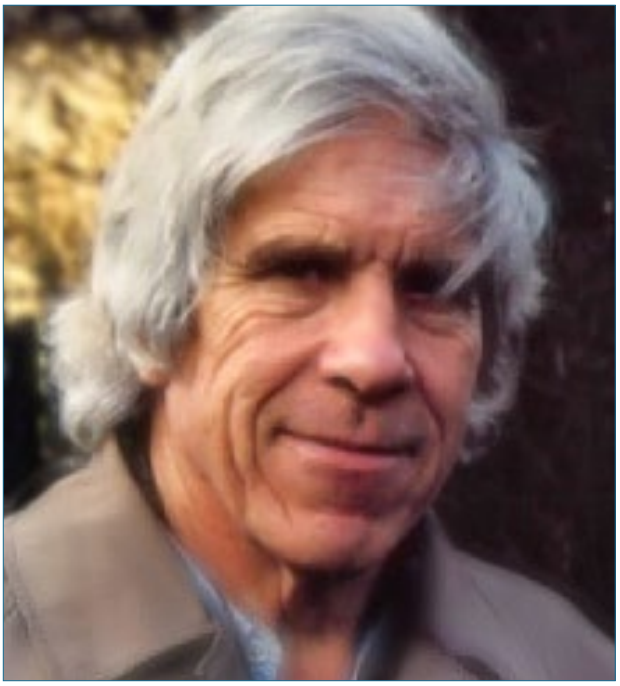

Figure 1. W.D. Hamilton, in order to explain the rise of altruism, saw how circumscribing aid to your immediate offspring would stifle the development of morality. He thus proposed the highly theoretical idea of kin selection, which would permit help to less genetically connected relations.

Image: Lindasmith0, Wikimedia / CC BY-SA 4.0

Figure 2. Hamilton's Rule: C < rB, states that the frequency of an altruistic trait in a population will increase if the fitness cost paid for helping, C, is less than the product of the average benefit provided to another, B, and the degree to which the two individuals are related, r.

seminal paper, he wrote about the disadvantageous effect indiscriminate social behaviour toward a neighbour would have on an individual's fitness. If only this individual, he mused, "could learn to recognize those of his neighbours who were really close relatives and could devote his beneficial actions to them alone an advantage to inclusive fitness would at once appear."[10] Immediately following was his personal *deus ex machina*: "Thus a mutation causing such discriminatory behaviour itself benefits inclusive fitness and would be selected."[11]

Though ostensibly a mathematical model, it took a gain, where none was warranted, moulded by special pleading. Olsen labelled this the fallacy of wishful thinking.[12] In order to account for an exigent ability of genes to recognize genetically similar genes in other individuals, Hamilton then goes on to postulate (read, 'invoke the spirit of') 'something like a supergene'.[13]

Once again, the problem of genetic drift could be raised. Sexual reproduction involves random sorting of genes, irrespective of their selective value. Kin selection proposes that altruism involves a gene mutation that promotes the reproductive success of others. As John Sanford has pointed out:

> "Drift is especially strong in small populations, and tends to negate almost all selection. In very small populations selection is essentially neutralized (except selection against near-lethal mutations), and alleles are quickly lost or fixed randomly regardless of their fitness effect."[14]

Stuart Altmann dismissed altruism being proportionally provided according to the degree of relatedness: "In sum, deployment of altruism beyond closest kin is entailed not by kin selection theory per se but by a constellation of factors. At present, the optimal allocation of altruism is unknown."[15] Illustrating his case by the act of grooming and tick removal among social mammals, he argues that there is a point of diminishing return past which it just will not pay in the long term to help those not as closely related to you. It is far better, evolutionary speaking, to remove ticks from genetically closer relatives as the rewards are more tangibly effective than from those less related. However, not all transactions are worthwhile, even on this rule of thumb, and the altruistic individual may wander outside of the close genetic relation to others. For example, closer relatives may not be available, not be tick infected or require grooming.[16,17]

When failure means victory

Kin selection continues to hold an enduring appeal as a solution for one of evolutionary theory's counter-intuitive phenomena, homosexuality.[18] Detractors, however, have labelled homosexuality a 'paradox'[19] because it's inconsistent

with genes' 'urge' to reproduce themselves directly. Kirby sets out the problem:

> "… given the assumed differential reproductive output of heterosexuals and homosexuals, one would anticipate that homosexual orientation, once present in the population, would be driven to extinction over the course of many generations."[20]

Likening homosexuals to sterile castes in insects, E.O. Wilson (figure 3) originally proposed kin selection as a solution because homosexuals are liberated from the supposed costly investment of reproducing and channel their resources into their kin by other means.[21] This non-directly contributes to the genetic fitness of the homosexual by those who hold some of the homosexual relation's genes:

> "… homosexual aunts and uncles [find] good jobs for their nephews and nieces, or homosexual individuals [provide] unpaid nanny services to their siblings or [donate] money to their relatives during life and death."[22]

Calling it 'an alternative reproductive strategy' that enables homosexuals to 'reproduce by proxy', Ruse claims, with next to no supporting data, that Native American shamans tend to be homosexual and use their position to wield power and financially aid close relatives and others within their community. The vacuity of this explanation comes to light when he circularly concludes, "It seems plausible to suppose, therefore, that in such cases biology itself has promoted genes for manifesting homosexual inclinations and activity."[23]

Kin selection's explanation for homosexuality has come under attack because of its excessive dependence on theoretical modelling. Its initial charm was its unempirical, unfalsifiable, quality; but several authors have indicated problems with the hypothesis itself. There are constructional problems in as much as

> "… the degree of altruism toward kin required to offset the loss of direct reproduction would have to be extremely large [and] in contemporary societies, it does not appear that homosexual men are given special roles or privileges that would allow them to confer considerable benefits to kin [and t]he amount of time and effort that homosexual men spend pursuing nonreproductive sex and relationships must be at the expense of distributing resources toward kin."[24]

Further belying the kin selection argument, a study by Hewitt argues that homosexuals do not lavish their wealth on relatives but rather on their homophile sources:

> "[M]any gay consumers display a strong preference for dealing with gay professionals and business, but by implication shows the advantages enjoyed by gay realtors, travel agents, dentists, physicians, etc., who obtain preferential access to affluent customers."[25]

This is a direct refutation of any explanation dependent on kin selection.

A series of questionnaires tested if homosexuals *actually* did give more to their kin. Although limited in sample size (60 homosexual and 60 heterosexual men) and confined to a Western culture, the results were unequivocal. The study concluded that

> "… the data showed that there were no significant differences between heterosexual and homosexual men in any of the three family relationship scales (general affinity, generous feelings and benevolent tendencies) … [there is] little (if any) empirical support for the kin selection hypothesis of male homosexuality in Western populations."[26]

Bobrow and Bailey insightfully point out that "evolutionary explanations that raise as many questions as they answer are not compelling."[27]

Despite dead-end genetics, stalwart counterarguments persist. Jim McKnight, former Chair of Psychology at Western Sydney University, wrote that 'straight' men who carry the homosexual gene are superior to those without it. He speaks of how "homosexual genes confer a benefit to the species", and goes on to say:

> "Those straight men who have one homosexual gene (and here we are assuming a single gene for simplicity's sake; the actual situation is more likely polygenic) probably have an enhanced sex drive which leads to great numbers of children and to a retention of the balanced homosexuality gene. These straight men are therefore genetically superior by virtue of having a dose of gayness—at least in this respect."[28]

Faced with considerable conflicting evidence, Kirby settles for an "as yet undetermined, mechanisms [which] could be operational." He appeals to a 'highly speculative' solution:

> "… suppose that homosexual individuals are better "choosers" of new, resource-rich, geographical homes than heterosexual individuals and, on this basis, the groups with proportionally higher homosexual representation end up having higher reproductive outputs than those with proportionally less homosexual representation."[29]

It takes little processing to appreciate just how self-serving this justificatory claim is. Arguments that are data-free, lack control groups, have a complete dearth of anecdotal evidence, and omit any comparative scaling, are considerably more than 'highly speculative': they are self-deception.[30,31]

Then they take it all back

In a complete reversal of allegiance, E.O. Wilson has recently come out swinging and attacked kin selection and, by extension, inclusive fitness. He writes they are "fundamentally wrong". His most damaging criticism was the dearth of empirical proof, and, if it existed, it would be tied to a very limited number of social insects, almost

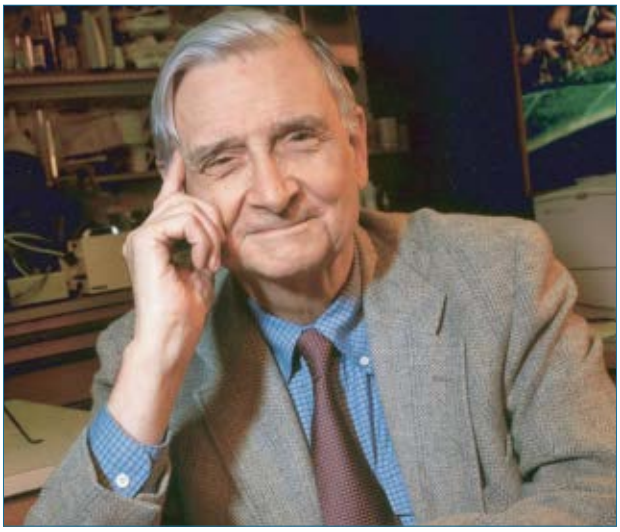

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Figure 3. E.O. Wilson. Evolutionists who reduce behaviour to genetics find generational continuation of homosexuality very problematic. E.O. Wilson proposed kin selection as a solution. Despite homosexuals surrendering 100% of their own genes by not reproducing, they supposedly aid close relatives who share some genetic common ground, thus spreading a proportion of their genetic material into the population.

Image: Cmacauley, Wikimedia / CC BY-SA 3.0

Figure 4. Yanomami woman and her child. Napoleon Chagnon's lengthy anthropological career among the Yanomamo catalogued the society's extremely high murder rate, even among close relatives. With up to almost 40% of males being killed, his work proved a strong counterfactual to kin selection.[41]

exclusively *Hymenoptera*. Field and laboratory studies of termite communities, once the paradigm for kin selection, showed they grew by taking in unrelated workers from other colonies. In a further denunciation, he said that they didn't explain these insects' sociality, the theory was too abstract, it didn't address disciplines such as neurobiology and ecology, and the standard theory of natural selection explains the field data better.[32] In a co-authored paper, Wilson argued that the idea of inclusive fitness failed on several fronts. Summing up, the writers stated:

> "… inclusive fitness theory attempts to find a universal design principle for evolution that applies at the level of the individual. The result is an unobservable quantity that does not exist in general … or has no predictive or explanatory value … . The dominance of inclusive fitness theory has held up progress in this area for many decades[which] has led to logical obfuscation and false claims of universality."[33]

Knauft's extensive field work among New Guinea tribes, particularly the Gebusi, refutes kin selection.[34] The Gebusi have one of the highest homicide rates in the world, some 40 times that of the US's, outside of its war periods. Furthermore, "at least 64.7% of the middle-aged men in two communities had committed homicide, including some who were among the least assertive and aggressive even by Gebusi standards." What makes the Gebusi's rate so significant is that there is no population to land pressure (the population density is a mere 2.6 persons per square kilometre), their political and economic life is highly decentralized, with no "big men or headmen, fight leaders, ritual eldership or gerontocracy", no competitive exchanges and a general sense of reciprocity in food exchanges, infrequent day-to-day hostile or aggressive demeanor and general "dynamics of noncompetitive egalitarianism [which, with] communal cooperation are genuine and deeply valued."[35]

Although sociobiology's staunch defenders were quick to attack Knauft's data,[36] the Gebusi's extraordinary killing rate nevertheless appeared to confute sociobiological predictions. These data were peculiar in that the victims had been accused of sorcery and their deaths, either immediately or through public torture with their bodies being eaten, were carried out with their kin's acquiescence and often initiated by close kinsmen (As an aside, Knauft notes that these practices were still alive due to the lack of, among other influences, mission intervention). The process of establishing guilt was decided through a perceived inability to adequately cook a divination packet of meat or fish, mediumship and séances. As Knauft points out, "Sociobiological theory predicts, other things being equal, that the incidence of interpersonal violence, particularly homicide, will vary inversely with the degree of biogenetic relatedness between offender and victim"[37] because kin selection depends on one's genes proliferating among related individuals. Complicity in the death of near kin would seem to clearly overturn kin selection. The killings mean the Gebusi are "dying out at an exceedingly rapid rate".[38] One reason for this is that young men are more likely to be the victim than older men, some 52.8% of all deaths for the former compared to 32% for the latter.[39]

Conclusion

Kin selection fails as an explanation for morality, arguably the quiddity of what it means to be human. It begs the question of an altruistic gene's coming into existence, is committed to unavoidable amounts of special pleading or highly contrived theoretical circumstances and, perhaps more crucially, cannot reasonably overcome that gene's poor fitness value.[40] When empirical projects are undertaken, they do not produce, and often contradict, the theory's predictive expectations (figure 4).[41]

In the next part of this paper, I will discuss another central explanation for altruism and the rise of human morality; namely, reciprocal altruism. Just as previous explanations have failed, so this also does for very similar reasons.

References

1. An early adumbration of a solution was laid out by the geneticist J.B.S. Haldane. Writing in 1932, Haldane stated that "Insofar as it makes for the survival of one's descendants and near relations, altruistic behaviour is a kind of Darwinian fitness, and may be expected to spread as a result of natural selection" (Haldane, J.B.S., *The Causes of Evolution*, Longmans, Green, London, p. 131, 1932, as cited in Waddington, C.H., Mindless Societies; in: Caplan, A.L. (Ed.), *The Sociobiology Debate: Readings on the ethical and scientific issues concerning sociobiology*, Harper and Row Publishers, New York, p. 254, 1978). R.A. Fisher also conceived of the maths a few years prior to Haldane. It is also argued that Darwin suggested something of the concept in the 8th chapter of his *On the Origin of the Species: By means of natural selection or the preservation of favoured races in the struggle for life*, Castle Books, Edison, New Jersey, 2004 (1859). On this see wikipedia.org/wiki/Kin_selection, accessed Sep 2021.
2. Hamilton, W.D., The genetic evolution of social behaviour—I, *J. Theoretical Biology* **7**(1):1–16, 1964; p. 1.
3. Hamilton's breakthrough followed from his observation that Hymenoptera (ants, bees, and wasps) have a remarkable mode of reproduction. What became known as the haplodiploid hypothesis, female workers, born from eggs fertilized by both the father and mother, share more of their genes with their sisters (75% due to receiving all their father's and half of their mother's) than with their potential offspring (50%) or brothers (25%), the latter arising from unfertilized eggs. This acts as an 'incentive' to assist their sisters to reproduce rather than themselves. Hamilton used this observation to explain the existence of altruism in higher-order animals. However, by the '90s the theory began to crumble due to, *inter alia*, its rarity among the social insects. For a comprehensive examination of what occurred, as well as the superficiality of "the connection that is made between data and theory", see Nowak, M.A., Tarnita, C.E., and Wilson, E.O., The evolution of eusociality, *Nature* **466**(7310):1057–1062, 26 Aug 2010.
4. While not specifically directed as a critique of biological modelling, Oreskes *et al.*'s article explaining the weaknesses and fallacies of numerical geo-modelling makes an insightful comment about modelling generally. The authors state: "we must admit that a model may confirm our biases and support incorrect intuitions. Therefore, models are most useful when they are used to challenge existing formulations, rather than to validate or verify them. Any scientist who is asked to use a model to verify or validate a predetermined result should be suspicious" (Oreskes, N., Shrader-Frechette, K., and Belitz, K., Verification, validation, and confirmation of numerical models in the earth sciences, *Science* **263**(5147):644, 4 Feb 1994). This is particularly apposite as so much of the explanation for the rise of morality is based on highly artificial, self-serving modelling.
5. Hamilton, ref. 2, p. 16. Note the corollary flip side to Hamilton's altruistic proposal: "Clearly from a gene's point of view it is worthwhile to deprive a number of distant relatives in order to extract a small reproductive advantage."
6. Bertram, B.C.R., Problems with altruism; in: King's College Sociobiology Group (Ed.), *Current Problems in Sociobiology*, Cambridge University Press, Cambridge, p. 263, 1982. Kin-recognition systems also stand in need of explanation and its hypothetical existence has been theorized to further support the moral proscription and disgust toward incest. See Lieberman, D., Tooby, J., and Cosmides, L., Does morality have a biological basis? An empirical test of the factors governing moral sentiments relating to incest, *Proceedings: Biological Sciences* **270**(1517):819–826, Apr 2003.
7. MacMillan, J. and Kofoed, L., Sociobiology and antisocial personality: an alternative perspective, *J. Nervous and Mental Disease* **172**(12):701–706, Dec 1984; p. 702.
8. Dawkins, R., *The Selfish Gene*, Oxford University Press, Oxford, p. 103, 1976. An extremely disturbing flipside to kin selection's *raison d'être* is Martin Daly and Margo Wilson's study on child abuse in families containing a stepparent, in particular when it's a stepfather. According to the authors, stepchildren are murdered at a rate of up to seventy times greater than a corresponding group of genetically related ones. Upsetting as this statistic is, more so are the authors' "evolution-minded hypothesis about step-parent reluctance and resentment". They conclude that a "hypothetical psyche that treated stepchildren and genetic children exactly alike would be a psyche vulnerable to exploitation, and would be evolutionarily unstable in competition with more discriminating alternatives. There is, then, a strong theoretical rationale for expecting that the evolved human psyche contains safeguards against allowing a mere stepchild, however appealing, easy access to that special mental category occupied by genetic children, the appropriate objects for the most nearly selfless love we know." Daly, M. and Wilson, M., *The Truth about Cinderella: A Darwinian view of parental love*, Yale University Press, New Haven, CT, pp. 33, 66, 1999. For an alternative explanation to Daly and Wilson's see Jalava, J., Griffiths, S., and Maraun, M., *The Myth of the Born Criminal: Psychopathy, neurobiology, and the creation of the modern degenerate*, University of Toronto Press, Toronto, p. 74, 2015.
9. Wilson, E.O., *Sociobiology: The new synthesis*, The Belknap Press of Harvard University Press, Cambridge, MA, p. 120, 2000. For an insightful article concerning the problems of Hamilton's argument, as well as other important theorists, see Schwartz, J., Population genetics and sociobiology: conflicting views of evolution, *Perspectives in Biology and Medicine* **45**(2):224–239, 2002. Also note: "Inclusive fitness is simply a method of calculation, but one that works only in a very limited domain [and] Hamilton's rule … has blunted inquiry into mechanisms that foster and maintain sociality in the diverse lineages where sociality has evolved" (Natural selection versus kin selection, *Nature*, Supplementary Information, p. 3, ped.fas.harvard.edu/files/ped/files/nature09205-s1_0.pdf | doi: 10.1038/nature09205, accessed 23 Aug 2021).
10. Hamilton, W.D., The genetical evolution of social behaviour: II, *J. Biology* **7**(1):17–52, Jul 1964; p. 21.
11. Hamilton, ref. 10, p. 22.
12. Olsen, R.G., *Meaning and Argument*, Harcourt, Brace and World, New York, 1969, as cited in Voorzanger, B., No norms and no nature—the moral relevance of evolutionary biology, *Biology and Philosophy* **2**(3):253–270, Jul 1987; p. 268.
13. Hamilton, ref. 10, p. 25.
14. Sanford, J.C., *Genetic Entropy and The Mystery of the Genome*, FMS publications, Waterloo, NY, p. 217, 2008. The scenarios that evolutionists imagine where an altruistic gene first appeared all indicate a small population group. The impact of drift is universally ignored in these just-so stories. The problem is not ameliorated by invoking large populations either. Sanford also notes that "we cannot make noise 'go away' by invoking larger population sizes. Noise is always present, and at much higher levels than is normally acknowledged by population geneticists. In fact, very large populations invariably have enhanced noise. This is, in part, due to population substructure (many smaller subpopulations, each with its own gametic sampling fluctuations). It is also because bigger populations extend over a wider range of environments, becoming subject to even more environmental variation ... . Small population size certainly aggravates the noise problem, but large population size cannot eliminate this problem" (pp. 97–98). See also his detailed discussion on pp. 204–205.
15. Altmann, S.A., Altruistic behaviour: the fallacy of kin deployment, *Animal Behaviour* **27**(3):958, Aug 1979.
16. No supporting documentation is provided, but Kitcher writes that social grooming is a puzzle because "the hygienic benefits actually received are disproportionally small in relation to the amount of time invested" (Kitcher, P., Between fragile altruism and morality: evolution and the emergence of normative guidance; in: Boniolo, G. and De Anna, G. (Eds.), *Evolutionary Ethics and Contemporary Biology*, Cambridge University Press, Cambridge, p. 161, 2006).
17. Subsequently, I identify a strong tendency for evolutionists to indulge in anthropomorphic language when describing primate behaviour. However, borrowing attributives more apposite to human actions doesn't end at primates. The real and, allow me to suggest, desperate need for evolutionary theory to demonstrate that altruism is so plastic that it reaches across phyla, and thus is not seen as something special, can no better be illustrated than in the following quote: "Another unambiguous example of kin fidelity is revealed in the experiment of Turner and Chao (1999), in which a bacteriophage evolved lower levels of *selfishness* when bacteria were infected with phage clone mates than when infected with nonclone mates [emphasis added]" (Sachs, J.L., Mueller, U.G., Wilcox, T.P., and Bull, J.J., The evolution of cooperation, *The Quarterly Review of Biology* **79**(2):143–144, Jun 2004).

18. Also note that kin selection has been leant upon as somewhat 'discreet' justification for incestuous pedophilic behaviour because it raises "the inclusive fitness of one or both of the interactants" (see Feierman, J.R., A biosocial overview of adult human sexual behavior with children and adolescents; in: Feierman, J.R. (Ed.), *Pedophilia: Biosocial dimensions*, Springer-Verlag, NY, pp. 25ff, 1990). Citing Wakefield's criteria for psychopathological non-adaptive behaviour, and putting it down to an *in utero* failure of the brain's hormonal mechanism, Quinsey and Lalumière argue that pedophilia, *inter alia*, "results from the inability of some mental mechanism to perform its natural function, wherein a natural function is an effect that is part of the evolutionary explanation of the existence and structure of the mental mechanism (the explanatory criterion)" (Wakefield, J.C., The concept of mental disorder: on the boundary between biological facts and social values, *American Psychologist* **47**(3):301–315, Mar 1992; pp. 384. Cited in: Quinsey, V.L. and Lalumière, M.L., Evolutionary perspectives on sexual offending, *Sexual Abuse: A Journal of Research and Treatment* **7**(4):301–315, Oct 1995; p. 308).
19. Bobrow, D. and Bailey, J.M., Is male homosexuality maintained via kin selection? *Evolution and Human Behavior* **22**(5):361–368, Sep 2001; p. 361. Bailey *et al.* also hold that homosexuality is caused by an X-linked gene. See Bailey, J.M. *et al.*, A Family history study of male sexual orientation using three independent samples, *Behavior Genetics* **29**(2):79–86, Mar 1999. William Byne presents an important critical summary of the biological theories that lend support to a materialist explanation for homosexuality. Although his paper is almost three decades old the theories he discusses are still being, unfortunately, bandied about by both scholars and lay people. See Byne, W., Human Sexual orientation: the biological theories reappraised, *Archives of General Psychiatry* **50**(3):228–239, Mar 1993.
20. Kirby, J., A new group-selection model for the evolution of homosexuality, *Biology and Philosophy* **18**(3):683 Nov 2003; pp. 683–694. Of course, one may just as easily remain quite positive about the matter and apply Donald Campbell's advice: "I believe the case for sociocultural evolution is strong enough so that psychologists and other social scientists, when considering an apparently bizarre, incomprehensible feature of their own social tradition, or that of another culture … expecting that when eventually understood, when our theories have caught up with it, that seemingly bizarre superstition will turn out to make an adaptive sense" (Campbell, D.T., On the conflicts between biological and social evolution and between psychology and moral tradition, *American Psychologist* **30**(12):1103–1126, Dec 1975; p. 1105).
21. Wilson, ref. 9, pp. 428, 468, 513, 693. Also see his *On Human Nature*, Harvard University Press, Cambridge, MA, pp. 144–147, 1978. It's quite possible in this latter book that Wilson expresses something of the real object for his interest in this subject. After providing brief anecdotal anthropological support for the perceived ubiquity of homosexuality in contemporary hunter gatherer and simple agricultural societies—they are, after all, 'less removed' from the earlier cultures we've evolved from—he warns that these anthropological "clues are enough to establish that the traditional Judeo-Christian view of homosexual behaviour is inadequate and probably wrong. The assumptions of this religion-sanctioned hypothesis have laid hidden for centuries but can now be exposed and tested by objective standards" (pp. 146–147). As further demonstration of urgency, Kirkpatrick has argued that homosexuality is "a *survival* strategy, not a *reproductive* strategy [and] will be best explained by reference to the costs and benefits of reciprocal altruism" (Kirkpatrick, R.C., The evolution of human homosexual behavior, *Current Anthropology* **41**(3):385–413, Jun 2000; p. 388). For an explanation of reciprocal altruism see my forthcoming part 4.
22. Kirby, ref. 20, p. 689. Notwithstanding Kirby's well-grounded scepticism that kin selection and other explanations for homosexuality have no genuine empirical support, Kirby's own explanatory group model is a paradigmatic exercise in tendentiousness. It begins with a parent group containing 100 heterosexuals and another (most unlikely) group of 100 homosexuals. Conveniently, before natural selection can act upon the group's homosexual members, it splinters, creating counterintuitively, a 'fitter' colony of 10 heterosexuals and 90 homosexuals and a substantially 'less fit' one of 90 heterosexuals and 10 homosexuals. This comes about because Kirby randomly assigns fitness values to each splinter group in which the first subgroup's members are given higher fitness values than their comparable members in the second subgroup. In other words, while recognizing the fact that, *ceteris paribus*, heterosexuals have more children than homosexuals, Kirby assigns fitness values to heterosexuals and homosexuals of 10 and 6 respectively in the first, and 5 and 3 respectively in the second. Globally averaged out (the average across the two groups), the heterosexual average attains a fitness value of 5.5 and the homosexual, 5.7. Another interesting paper exploring the difficulty is Vasey, P.L. and VanderLaan, D.P., Sexual orientation in men and avuncularity in Japan: implications for the kin selection hypothesis, *Archives of Sexual Behavior* **41**(1):209–215, Feb 2012. This paper rules out elevated avuncular tendencies in androphilic males as an adaptive cause for homosexuality. What is of further interest in this latter paper is the unblushing urgency of incorporating auxiliary hypotheses to vindicate evolution's lack of oracular ability for the persistent presence of human homosexuality. Hypothetical reasons include the existence or lack of transgenderism, homophobia, and childhood separation anxiety.
23. Ruse, M., The morality of homosexuality; in: Baker, R. and Elliston, F. (Eds.), *Philosophy of Sex*, Prometheus Books, New York, pp. 380, 381, 1984.
24. Bobrow and Bailey, ref. 19, pp. 362–363. See the extensive references in this paper for others who have further criticized the hypothesis. Trivers also comments homosexual relations would divert energy and resources from kin to same-sex partners: "the sexual and romantic side of homosexual relations would seem to interfere with kin-directed altruism: insofar as one is sexually attracted to another individual, one will naturally be inclined to invest some resources in intrasexual competition to gain this individual's favors. Should the relationship blossom into a love relationship, it will be natural to devote some of the same resources and energy that would go into a loving heterosexual relationship" (For the full argument, see Trivers, R., *Social Evolution*, Benjamin/Cummings, Menlo Park, CA., p. 198 and passim, 1985).
25. Hewitt, C., The socio-economic position of gay men—a review of the evidence, *American J. Economics and Sociology* **54**(4):461–479, Oct 1995; p. 475. In his conclusion, Hewitt writes, "Gay activists paint a bleak picture of employment discrimination against homosexuals [yet o]ur review of the evidence suggests that such claims are certainly exaggerated. Gays are more successful than heterosexuals, and their occupational distribution is as much a result of preference as discrimination" (p. 476).
26. Rahman, Q. and Hull, M.S., An empirical test of the kin selection hypothesis for male homosexuality, *Archives of Sexual Behavior* **34**(4):461–467, Aug 2005; pp. 465–466. Bobrow and Bailey's study likewise reported that "contrary to predictions from the kin selection hypothesis of male homosexuality, we found no evidence that gay men are generous to their relatives [when contrasted with heterosexual men]" (ref. 19, p. 366). Of considerable interest is a thorough analysis of data relevant to, inter alia, homosexuality, bisexuality and gender polymorphism in Mayer, L.S. and McHugh, P.R., Sexuality and gender: findings from the biological, psychological, and social sciences, *The New Atlantis*, Special Report: Sexuality and Gender, Center for the Study of Technology and Society **50**:10–143, Fall 2016. However, note Vasey and Vanderlaan, ref. 22, where they point out the stark cultural differences between a Western homosexual culture and their researched Samoan milieu.
27. Bobrow and Bailey, ref. 19, p. 367. Also see Vasey and VanderLaan, ref. 22. Measured in categories such as babysitting, tutoring, and providing money for their siblings' education, the data collected seem to support the authors' hypothesis that "fa'afafine [transgender men] exhibited greater avuncular tendencies relative to gynephilic men, both with and without children" (p. 827). However, the authors conclude that "it is possible that androphilia in *fa'afafine* does not represent an evolved adaptation for increasing kin directed altruism [and] it is equally possible that elevated avuncular tendencies do not represent an evolved adaptation for offsetting the reproductive cost of male androphilia" (p. 828). And despite multiple, quite often tentative, qualifications connecting these heightened avuncular tendencies to kin selection, the authors admit their fieldwork does not contribute anything to the rise of homosexuality as such: "more research will be needed to test these various evolutionary perspectives on the origins and maintenance of male androphilia" (p. 828). Elsewhere the same authors conclude, "more research will be necessary before strong claims can be made about the evolutionary basis of *fa'afafine*'s elevated avuncularity or their androphilic orientation" (Vasey, P.L. and VanderLaan, D.P., Monetary exchanges with nieces and nephews: a comparison of Samoan men, women, and *fa'afafine*, *Evolution and Human Behavior* **31**(5):373–380, Sep 2010; p. 379). Another attempt to explain away the enigma of human homosexuality involved a comparison with marmoset monkey studies. The males, apparently, share the child-rearing responsibilities with the females, and from this it's concluded that human homosexual households can lead to positive child outcomes. For a brief explanation of this, see Silverstein, L.B. and Auerbach, C.F., Deconstructing the essential father, *American Psychologist* **54**(6):397–407, Jun 1999; p. 400. In borrowing these monkey data, the authors make their objective plain: "we do not believe that the data support the conclusion that fathers are essential to child well-being and that heterosexual marriage is the social context in which responsible fathering is most likely to occur … that neither mothers nor fathers are unique or essential … the emphasis on the essential importance of fathers and heterosexual marriage represents … an attempt to reassert the cultural hegemony of traditional values, such as heterocentrism, Judeo-Christian marriage" (pp. 398, 399, 404). The authors make reference to the original study by Smuts, B.B. and Gubernick, D.J., Male-infant relationships in nonhuman primates: paternal investment or mating effort? in: Hewlett, B.S. (Ed.), *Father-Child Relations: Cultural and biosocial contexts*, Aldine de Gruyter, New York, pp. 1–31, 1992. One academic gave the paper the only possible judgement, calling it 'unusually silly' (Dailey, T.J., Homosexual parenting: placing children at risk, ac21doj.org/contents/homosexuality/homosexualParentingPlacingChildrenAtRisk.html, accessed 4 Sep 2021).
28. McKnight, J., *Straight Science? Homosexuality, evolution and adaptation*, Routledge, New York, pp. 76, 77, 1997. He also claimed that women are attracted to heterosexual men carrying a homosexual gene because these men are more like the women. These 'homosexually enabled' men make better lovers, partners, and fathers because they offer more "sensitivity, creativity and better communication skills" (p. 106). Though not as bizarre, but certainly equally as baffling, is the

tautological "Homosexuality may have evolved to promote same sex affiliation through a conserved neurodevelopmental mechanism" (Rahman, Q. and Wilson, G.D., Born gay? The psychobiology of human sexual orientation, *Personality and Individual Differences* **34**(8):1337–1382, Jun 2003; p. 1337). In other words, same sex affiliation may have evolved to promote same sex affiliation. For two brief, but sufficient responses to the main arguments put forward in support of a biological origin of homosexuality, see Byne W. and Lasco, M., The origins of sexual orientation; in: Corvino, J. (Ed.), *Same Sex: Debating the ethics, science, and culture of homosexuality*, Rowman and Littlefield Publishers, Lanham, MD, pp. 107–120,1999; and Dallas, J., *The Gay Gospel? How pro-gay advocates misread the Bible*, Harvest House, Eugene OR, pp. 111–133, 2007.

29. Kirby, ref. 20, pp. 692–693. For further attempts to explain homosexuality's evolutionary origin and continued existence, see Rahman and Wilson, ref. 28, pp. 1343–1349. The whole paper is a wealth of information referencing the putative bio-genetic explanations for homosexuality.
30. One other highly theoretical and vacuous explanation is set out by Weinrich: "homosexual and heterosexual couples alike report that the highly charged sexual excitement so prominent in early couplehood recedes to a more stable level of bondedness that is less 'sexy' but retains an erotic tinge. It is a reasonable hypothesis that the highly charged component of sexual attraction could have functioned, as in preadaptation, as the initial emotional motivator of behaviours that lead to a same-sex bond; once the bond is formed, other bonding mechanisms (which need not include such genitally focused sexuality) can come into play" (Weinrich, J.D., A new sociobiological theory of homosexuality applicable to societies with universal marriage, *Ethology and Sociobiology* **8**(1):37–47, 1987; p. 43). He also describes another idea involving 'limerence', "the ability to fall head-over-heels in love with another individual, an ability shared by heterosexuals, homosexuals, and bisexuals alike" and which leads to the purpose of "motivating extramarital, rather than marital, bliss." How does this explain homosexuality's value? No problem: "one difference of reproductive significance between homosexuals and heterosexuals in a society in which everyone gets married would be that heterosexuals have extramarital affairs with members of the other sex, whereas homosexuals have them with members of their own sex. This possibility has an immediate consequence for R[eproductive]S[uccess]: that heterosexuals in such a society are more likely to have children out of wedlock than homosexuals are. Hence, being homosexual in such circumstances can be, as in the orthodox theory, a reproductive altruistic act" (*Ibid*, pp. 41–42).
31. For an overview of how important the evolutionary view was to explaining the rise and continuance of homosexuality, see Bayer, R., *Homosexuality and American Psychiatry: The politics of diagnosis*, Basic Books, New York, pp. 20–47, 1981. Summarising the late 19th-century criminologist Cesar Lombroso, Bayer writes: "[he] argued that homosexuals were at a lower stage of human development than heterosexuals. Though the human race had evolved over eons, leaving behind its own primitive behavior, each child was required to recapitulate the process in the course of its own development. Those with defective heredity failed to complete that process and remained at a less civilized point in the evolutionary course" (p. 20). Bayer's book thoroughly examines the history and the politics behind the removal of homosexuality as a pathological disorder from the Diagnostic and Statistical Manual of Psychiatric Disorders (DSM), psychiatrists' official list of mental diseases. His work presents as disinterested research and competently rises above the often emotionally charged atmosphere that this subject historically generates.
32. Wilson, E.O., *The Meaning of Human Existence*, Liveright Publishing Corporation, New York, pp. 61–75, 2014. What is arguably of more interest than this in-house squabbling is the accusation levelled by Wilson that the evolutionary establishment was viewing him and his small troop of supporters as heretics and that there was a conspiracy to silence or ignore their work. Wilson writes how Richard Dawkins (revealing some of his resentment, he calls Dawkins an 'eloquent science journalist') "responded with the indignant fervour of a true believer [of inclusive fitness]. In his review for the British magazine *Prospect*, Dawkins urged others not to read what Wilson had written, but instead to cast the entire book away, 'with great force', no less." See Keim, B., E.O. Wilson proposes new theory of social evolution, *Wired*, 26 Aug 2018, wired.com/2010/08/kin-selection-challenged/; and Johnston, C., Biological warfare flares up again between E.O. Wilson and Richard Dawkins, *The Guardian*, 7 Nov 2014, theguardian.com/science/2014/nov/07/richard-dawkins-labelled-journalist-by-eo-wilson, accessed 4 Sep 2021. Washing his hands of his past claims, Wilson stated, "But ask me what ants have to say about how we should behave and what they tell us about our own morality. The answer is nothing. Their societies are almost completely female. They eat their injured and they are in almost constant, obliterating war with colonies of the same species. And whereas we send our young men to war, they send their old ladies. There's not much there to be learnt." Connor, S., Why Richard Dawkins 'is not a scientist', the survival of the least selfish, and what ants tell us about humans—E.O. Wilson on his new book, *The Independent*, 10 Nov 2014, independent.co.uk/news/science/why-richard-dawkins-no-scientist-survival-least-selfish-and-what-ants-can-tell-us-about-humans-eo-wilson-his-new-book-meaning-human-existence-9849956.html, accessed 4 Sep 2021.
33. Allen, B., Nowak, M.A., and Wilson, E.O., Limitations of inclusive fitness, PNAS **110**(50):20135–20139, Dec 2013; p. 20138.
34. Knauft, B.M., Reconsidering violence in simple human societies: homicide among the Gebusi of New Guinea, *Current Anthropology* **28**(4):457–500, Aug–Oct 1987.
35. Knauft, ref. 34, pp. 460, 466, 476.
36. See esp. Daly and Wilson's reply in Knauft, ref. 34, pp. 482–483.
37. Knauft, ref. 34, p. 467.
38. Knauft, ref. 34, p. 491.
39. Knauft excoriates Daly and Wilson for claiming that sociobiology is irrefutable and thus adopting it as "a religious faith [and for not giving] up the cloak of sociobiological sanctity" (Knauft, ref. 34, p. 493).
40. Several researchers have commented on the best kept secret of genetics, for example "Since most mutations, if they have any effect at all, are harmful, the overall effect of the mutation process must be deleterious" (Crow, J., The high spontaneous mutation rate: is it a health risk? PNAS **94**(16):8380–8386, Aug 1997; p. 8380). "… the vast majority of mutations are deleterious. This is one of the most well-established principles of evolutionary genetics, supported by both molecular and quantitative-genetic data" (Keightley, P.D. and Lynch, M., toward a realistic model of mutations affecting fitness, *Evolution* **57**(3):683–685, Mar 2003; p. 684); and despite opposing Keightley and Lynch, others do make a small concession concerning the problem: "we agree [with Keightley and Lynch] that of the modest body of evidence bearing *directly* on the question of directionality of mutational effects, there is considerable support for the view that the majority of mutations are deleterious in most organisms that have been studied" (Shaw, R.G., Shaw, F.H., and Geyer, C., What fraction of mutations reduces fitness? a reply to Keightley and Lynch, *Evolution* **57**(3):686–689, Mar 2003; p. 688). Also note the tendency to perpetual fitness decline as mathematically modelled in Basener W.F. and Sanders, J.C., The fundamental theorem of natural selection with mutations, *J. Mathematical Biology* **76**(7):1589–1622, Jun 2018.
41. Napoleon Chagnon unintentionally puts forward adamantine evidence, gathered over decades of field research while living with the South American Yanomamö, which would clearly appear to undermine the theory of kin selection. While fully supportive of evolutionary theory, particularly understanding it in terms of reproductive survival, he nevertheless writes that "kinship is not an impediment to lethal violence" (Chagnon, N.A., *Noble Savages: My life among two dangerous tribes—the Yanomamö and the anthropologists*, Simon and Schuster Paperbacks, New York, p. 73, 2013. Also see his *Yanomamö: The fierce people*, Holt, Rinehart and Winston, New York, 1977). Yanomamo societies are a demi-Hobbesian "pure state of nature"; that is to say, a *bellum omnium contra omnes*, where life is "nasty, brutish and short". He presents a plethora of incidents and statistics to buttress this claim that close relatives do murder each other for what seems, from an evolutionary perspective, counter-intuitive and ultimately internecine. Also see David McKnight's anthropological work among Northern Australian Aborigines, in particular the intra-tribal violence. Summarizing previous studies, McKnight writes: "35 Kaiadilt were killed by other Kaiadilt during the years 1910–1947 … . Given that the mean population fluctuated from 105–120, the homicide rate was about one a year" (McKnight, D., *Of Marriage, Violence and Sorcery: The quest for power in Northern Queensland*, Ashgate Publishing, Aldershot England, p. 47, 2005). Compellingly, McKnight puts the violence substantially down to the existence of polygyny. More interestingly, McKnight states, "During the years 1948–1978, when the Kaiadilt were under Mission hegemony, there were no killings" (p. 55).

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Did post-Flood North American mammals live above their dead Flood relatives?

Michael J. Oard

The geology of the Rocky Mountain valleys and basins and the High Plains of the United States indicates that the Flood/post-Flood boundary in those regions is high in the Cenozoic. Proponent of a K-Pg post-Flood boundary Marcus Ross found that 70 of 303 North American genera (28 families) cross the Blancan/Irvingtonian boundary, a rough proxy for the Pliocene/Pleistocene. The Paleobiology Database shows that all the North American families Ross studied, and most of his North American genera, are also found on other continents both before (Tertiary) and after (Pleistocene) the end of the Flood. Moreover, during the nine years since Ross used the Paleobiology Database and 2020, an additional 5% new genera and/or families were added to North America, and 12% of Tertiary and/or Pleistocene genera were subtracted from the database. Because of these recent alterations, Ross's study of North American mammals does not negate a Late Cenozoic Flood/post-Flood boundary in North America.

In a previous paper,[1] I clarified my position on the Late Cenozoic post-Flood boundary. One of my main points is my disbelief in a one-to-one correlation between uniformitarian epochs and precise time intervals in biblical earth history. My definition of the post-Flood boundary with respect to the geologic column fluctuates from location to location within the Late Cenozoic. Sometimes it may be in the Miocene, Pliocene, or Quaternary. I believe the post-Flood boundary can cross uniformitarian stratigraphic lines. In exceptional cases, the boundary may be lower than the Late Cenozoic, such as for the Antarctic Ice Sheet and likely the Australian marsupial fossils.[2] Each location needs to be evaluated on its own merits. There should be a fossil break, as Ross stated:

> "I submit that a robust biostratigraphic analysis aids in determining the location of the Flood/post-Flood boundary, since a pronounced biostratigraphic break marking the termination of the Flood should be expected by all creationists."[3]

However, it is unlikely that we will find that biostratigraphic break by assuming a false precision for the uniformitarian geological column in biblical earth history.

In order to evaluate the location of the post-Flood boundary, I identified 33 factors that support a Late Cenozoic boundary in most places,[1] and Clarey added some more.[4–6] This paper examines Marcus Ross's fossil claims for the North American continent.

For Australian marsupials, Arment's argument[7] that the boundary is below the Late Oligocene is likely valid *at the locations* he describes, but does not carry over to other locations, especially given some questionable uniformitarian dating methods. There is a definite biostratigraphic break in Australia with one marsupial location well below the Late Oligocene that has been placed in the Early Eocene.[8] That older group is likely from the Flood, and part of worldwide marsupial burial on other continents.

We do not know where North American mammals and Australian marsupials lived before the Flood; we do not even know the exact configuration of the antediluvian continents.[9] We do know that mammals were preserved on the Ark and dispersed after the Flood. Determining these issues is a matter for more research, and each location and region must be evaluated by field criteria on its own merits.

Some Early to Mid-Pleistocene mammals from the Flood

For example, Cenozoic mammal fossils of the Rocky Mountain basins and valleys and High Plains are interpreted to be from the Flood.[10,11] This is based especially on the ash deposit from the last super-eruption of the Yellowstone volcano, assuming that researchers can determine which Midwest ash corresponds to which of the three claimed Yellowstone super-eruptions.

The Yellowstone super-eruptions are interpreted to have occurred during the Flood.[10] Ash from the last eruption, Lava Creek B, occurs southeast of Yellowstone in the gravel of a pediment remnant in the upper Wind River Basin of Wyoming, USA. Pediments are unique features formed by channelized Flood runoff.[12] This ash layer is also found with mammal fossils in the Midwest, assuming that the Midwest ashes can be correctly identified. It follows that if the Midwest ash came from Yellowstone during the Flood, the High Plains mammals below this ash must also be from the Flood.

Ross's argument against the Late Cenozoic Flood boundary

Ross's challenge is: why did postdiluvian mammals return to North America where their ancestors were buried in the Flood, assuming the pre-Pleistocene mammals are from the Flood? Ross gave the example of the pronghorn antelope—living today *and* found in the Tertiary of North America. We would not expect boundary crossing sub-baraminic varieties, such as genera, to have identical morphology.

Ross examined Cenozoic mammals of North America and points out identical genera both before and after the Flood/post-Flood boundary, which he assumed was the Pliocene/Pleistocene boundary. He concluded that the stratigraphic distribution of North American mammal families and genera indicate that the post-Flood boundary must be much lower, near the K-Pg boundary, not the Pliocene/Pleistocene.[13] He argues against a Late Cenozoic position, claiming that, in that case, numerous mammals would have had to migrate back to where their ancestors were buried in the Flood, which is improbable:

> "Regardless of the initial continental configuration [Rodinia or the present-day distribution], the following must be true if the Flood/post-Flood boundary is placed at or near the Pliocene/Pleistocene boundary: North American fossil taxa must have either inhabited the locations of their present fossil deposits (in North America) prior to the Flood, or they must have been transported exceptionally long distances *en masse* to North America during the Flood."[14]

Ross indicates that he is open to the long-distance transport of the North American mammals, but he seems to consider it highly unlikely, inferring that the original location likely was still on North America:

> "Because numerous boundary-crossing taxa would have to migrate from their North American pre-Flood habitats to board the Ark and return to their *same continent of origin* in the post-Flood world [emphasis added]."[3]

Ross stated, in a letter exchange with me, that the transport was short distance, and assuming long-distance transport is somehow inimical to a Late Cenozoic boundary:

> "… the analytical *results* favour near source deposition. In fact, by assuming long-distance transport for Cenozoic mammal fossils, Oard makes his case for a high post-Flood boundary difficult to the point of absurdity [emphasis in original]."[15]

Thus, "there would likely be no preference for any particular baramin to migrate to the starting locations of their now-deceased pre-Flood kin."[14] The family is the likely average taxonomic level of the Genesis kind or baramin. Using 28 families of North American mammals, Ross showed that all but one crossed the Pliocene/Pleistocene boundary, as defined by the proxy of the Blancan/Irvingtonian boundary.

The Blancan and Irvingtonian Land Mammal Ages are part of the North American Land Mammal Ages (NALMA), which Ross used to provide a finer scale and to eliminate non-North American genera. But this boundary is in the Early Pleistocene; the Early Blancan being Pliocene and the Late Blancan, Pleistocene. It is a poor proxy for the Pliocene/Pleistocene boundary, because a fossil in the Late Blancan in Ross's use of NALMA could be assigned as Flood, while, with a Pliocene/Pleistocene boundary, the same fossil could be assigned as post-Flood.

The fundamental differences in our positions are whether there is a precise one-to-one correlation between uniformitarian stratigraphic divisions and biblical earth history and Ross's reluctance to address the numerous other geological problems with a K-Pg boundary, including my own 33 factors and Clarey's additions. Ross accepts global synchronous uniformitarian boundaries as time markers in biblical history. I do not. The Pliocene/Pleistocene boundary could be close to the true post-Flood boundary for the Rocky Mountains valleys, but it could be below that boundary elsewhere, such as in Florida, where many

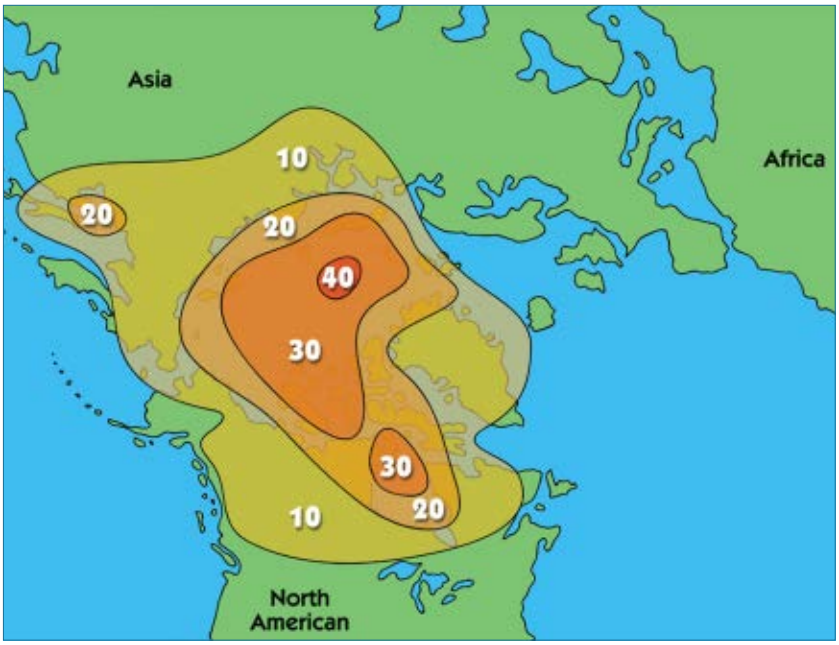

Figure 1. The amount of winter atmospheric warming from a model run by removing the Arctic Sea ice and leaving the temperature of the ocean at the freezing point of seawater (after Newson, 1973).[28]

mammals are found. To test this idea, I divided mammal taxa into Pleistocene and pre-Pleistocene (Tertiary), using the Paleobiology Database as a first approximation (see tables below). This database assumes that the identification and classification of organisms are correct and that their dates are accurate per the geological column.[16]

Ross divided the 28 North American families into 303 genera, of which 70 genera (23%) crossed the Blancan/Irvingtonian boundary in North America.[3] One would expect a few crossings, but not 70. His conclusion is that the Pliocene/Pleistocene boundary cannot be the post-Flood boundary.

Ross's arguments would be less significant if any of these North American mammal genera were also found on other continents, either in the Flood (pre-Pleistocene) or post-Flood (Pleistocene). For those boundary-crossing genera, there still is the question of whether we should expect them to be morphologically identical.

Could mammals have spread into the Americas in the Late Cenozoic?

Ross first argued that pre-Flood (Tertiary) mammals would have been adapted to its warm climate.[3] If so, it would have been difficult for them to migrate from Siberia to Alaska via the Bering Land Bridge during the Ice Age. Ross suggests that the mammals must have instead done so in the warmer Tertiary.

Figure 2. Map of Siberia and Alaska showing onshore flow of warm, moist air from the Arctic Ocean and the North Pacific. The long arrow off Asia represents a main storm track, becoming dashed into the Bering Sea as the track weakens. General downslope flow off the eastern Asian Mountains results in only mountain glaciation in eastern Asia.

However, the *immediate* post-Flood climate of Siberia, Alaska, and the northwest Yukon Territory, as well as the ice-free corridor in Alberta and Montana, would not present such a climate barrier.[17] Winters in Siberia, Alaska, and the Yukon Territory and other coastal areas would have initially been mild because the Arctic and Northern Pacific oceans were warm. If the Arctic ice cap were removed, winters at the North Pole would be 40°C warmer, and those in Northern Siberia, 20°C warmer, even if the Arctic Ocean water temperature were near freezing (figure 1). But those post-Flood oceans would have been around 20–30°C with onshore flow at times of warm air into Siberia, Alaska, and the Yukon Territory (figure 2). Winters would have been much warmer than the 20°C estimate without sea ice. The ice-free corridor along the eastern Rocky Mountains would have only been open *early* in the Ice Age due to downslope chinook winds that warm and dry the air as they descend east off the Rocky Mountains.[18]

Proof that animals spread to the Americas early in the Ice Age can be inferred based on the discovery of a Columbian mammoth[19] and a giant bison[20] in central British Columbia—the centre of the Cordilleran Ice Sheet. Such a fossil occurrence is not difficult to explain.[17] Likewise, ground sloths have been found in the Yukon Territory,[21,22] and camels in Alaska,[23] likely buried in their post-Flood trek to the Americas.

Are Ross's North American mammals unique to North America?

Ross has assumed that the Pleistocene North American families and genera were being buried atop their Tertiary North American relatives from the Flood, implying that they were unique to North America:

> "If pre-Flood baramins are better approximated by the taxonomic rank of family … then the situation is far more severe. Twenty-seven of the 28 mammal families studied here include at least one genus which crosses the Flood/post-Flood boundary when placed at the Pliocene/Pleistocene boundary, and many families display multiple boundary-crossing genera. So if the family approximates the baramin, then >96% of the mammal baramins evaluated here migrated from Laurentia/North America to the Ark and returned again to North America."[24]

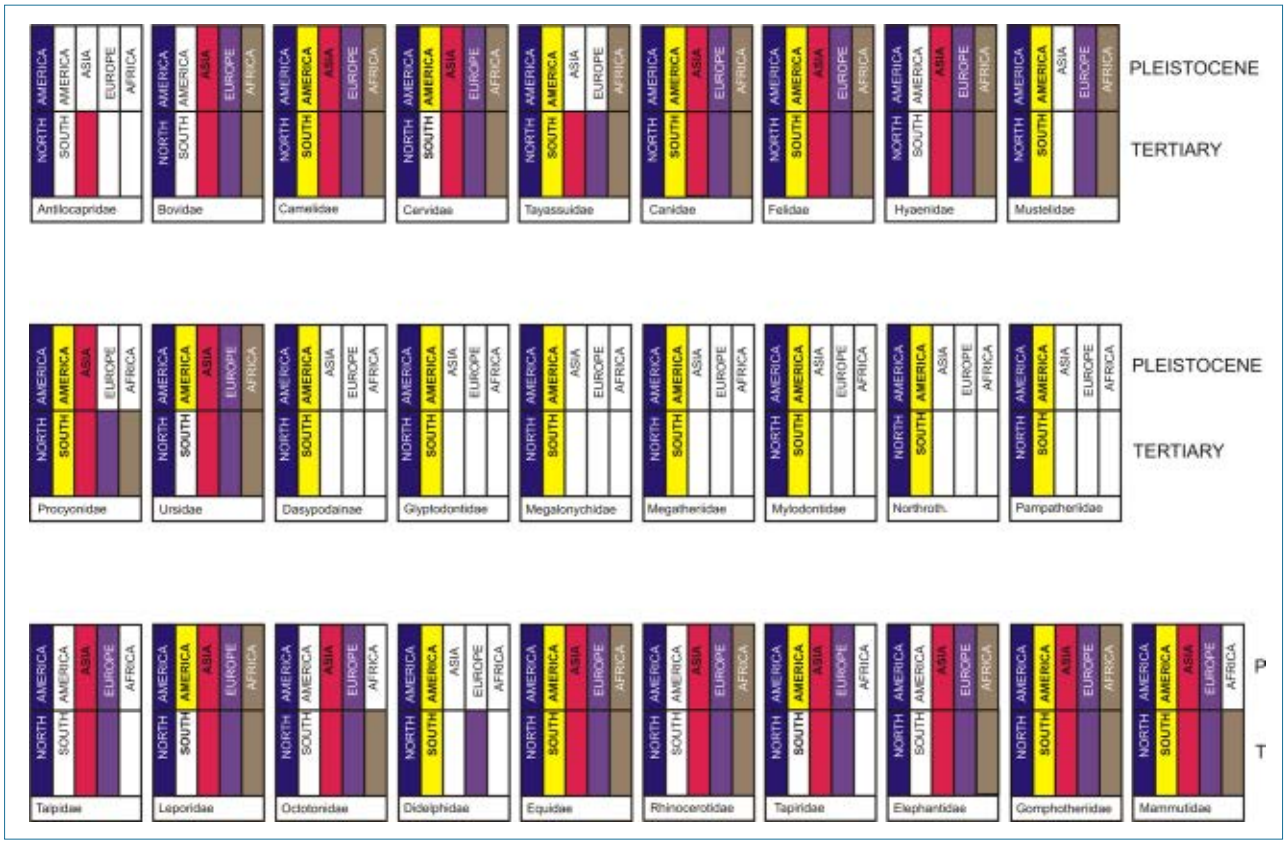

Figure 3. Bar graph of Ross's 28 families of North American mammals for the Pleistocene (post-Flood) and the Tertiary (pre-Flood) (plotted by Peter Klevberg). Blue represents North American families, yellow represents South American families, red represents Asian families, purple represent European families, brown represents African families, and white means that the family is missing.

A recent search of the Paleobiology Database[25] now shows that the one remaining family Ross wrote did not cross, the Rhinoceratidae, now has a Pleistocene representative in North America (table 1). So, 28 out of 28 families are found above and below the Pliocene/Pleistocene boundary in North America. It also shows that the Paleobiology Database is still a work in progress.

Table 1 and figure 3 show Ross's 28 families, their Tertiary distribution (assumed pre-Flood), and their Pleistocene distribution (assumed post-Flood) from the Paleobiology Database. If North American fossil mammals were found on other continents, in the Tertiary and/or the Pleistocene, the fossils would *not* be unique to North America. I discovered that *all* 28 families occur as Tertiary *and* Pleistocene fossils on *other continents*, not counting Antarctica or Australia. Even the family Antilocapridae, one that Ross showcased as exclusively North American,[13] now has a Miocene specimen from Asia (Japan). It should not be surprising that 28 mammal families crossed the assumed Flood/post-Flood boundary, since we should expect representatives of the same baramins to exist both before and after the boundary. After all, God sent baramins from the pre-Flood world into the Ark that would also exist after the Flood.

I also discovered that many of the *genera* that migrated to North America after the Flood are not just found on North America, contradicting the idea that post-Flood genera of North America ended up living above their dead Flood genera. I looked at all the genera in Anilicapridae[13] and from those families listed in the supplemental material of Ross's article.[26] They totalled to 205 out of Ross's 303 genera, or 68%, were analyzed. There were several surprises.

Most genera of Antilocapridae, Camelidae, Canidae, Leporidae, and Equidae are indeed unique to North America, although there were some within these families from other continents. The seven families of the order Edentata (not in the supplemental data)—ground sloths, armadillos, and glyptodons—are unique to North and South America (table 1)—a situation that still needs an explanation. The other genera analyzed commonly had representatives on other continents. Table 2 presents the genera of the Bovidae family, table 3, the genera of the Felidae family, and table 4, the genera of the Gomphotheriidae family.

One can see from tables 2–4 that many genera, including many of the boundary crossing genera, are not unique to North America. I also found about 5% more mammal genera, and one family were added to North America, such as the

Table 1. The North American mammal families listed by Ross that cross the Tertiary/Pleistocene boundary and their Tertiary and Pleistocene distribution on other continents, not including Antarctica or Australia.

Family	NA	NA	SA	SA	Asia	Asia	Europe	Europe	Africa	Africa
	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.
Antilocapr.	yes	yes			yes					
Bovidae	yes	yes			yes	yes	yes	yes	yes	yes
Camelidae	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Cervidae	yes	yes		yes	yes	yes	yes	yes	yes	yes
Tayassuidae	yes	yes	yes	yes	yes		yes		yes	
Canidae	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Felidae	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Hyaenidae	yes	yes			yes	yes	yes	yes	yes	yes
Mustelidae	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Procyon.	yes	yes	yes	yes			yes		yes	
Ursidae	yes	yes		yes	yes	yes	yes	yes	yes	yes
Dasypod.	yes	yes	yes	yes						
Glyptodont.	yes	yes	yes	yes						
Megalony.	yes	yes	yes	yes						
Megatheri.	yes	yes	yes	yes						
Mylodont.	yes	yes	yes	yes						
Northroth.	yes	yes	yes	yes						
Pampather.	yes	yes	yes	yes						
Talpidae	yes	yes			yes	yes	yes	yes		
Leporidae	yes	yes		yes	yes	yes	yes	yes	yes	yes
Octotonidae	yes	yes			yes	yes	yes	yes	yes	
Didelphidae	yes	yes	yes	yes			yes			
Equidae	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Rhinocerot.	yes	yes			yes	yes	yes	yes	yes	yes
Tapiridae	yes	yes		yes	yes	yes	yes	yes		
Elephant.	yes	yes			yes	yes	yes	yes	yes	yes
Gomphoth.	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Mammut.	yes	yes	yes	yes	yes	yes	yes	yes	yes	

NA = North America; SA = South America; yes = families cross the boundary; blank = do not cross

rhino mentioned above and a Miocene member of the genus *Cosoryx*, of Antilocapridae, found in Japan (Asia). I will assume that these represent nine more years of collecting for the database, showing that the true fossil distribution has not yet been fully established. Moreover, relying on fossils alone can lead to weak interpretations of the location of the Flood/post-Flood boundary. All it takes is one new discovery of a fossil elsewhere and it can change everything. In contrast, the geologic layers are much more voluminous and telling, with several dozen factors. Rocks supply stronger data in general than do fossils.

Furthermore, some genera Ross listed from the Tertiary and/or the Pleistocene have *disappeared* from the database for North America. For instance, in Bovidae (table 2), five of the 16 genera are no longer recorded for the North American Tertiary or Pleistocene. In Felidae (table 3), two genera

Table 2. An analysis of the genera of the North American family Bovidae from the Paleobiology Database. The order of the genera is the same as the order in Ross's supplemental information.[26]

Genus	NA	NA	SA	SA	Asia	Asia	Europe	Europe	Africa	Africa
	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.
Miotragoc.	yes				yes		yes		yes	
Eotragus					yes		yes		yes	
Palaeoryx					yes		yes		yes	
Prosterp.					yes		yes		yes	
Protoryx					yes		yes		yes	
Protragoc.					yes		yes		yes	
Neotragoc.	yes									
Ovis	yes	yes			yes	yes	yes	yes		yes
Bison	yes	yes			yes	yes	yes	yes		
Bootherium		yes								
Eucerather.		yes								
Dreamnos		yes								
Ovibos		yes				yes		yes		
Praeovibos		yes			yes	yes		yes		
Saiga		yes				yes		yes		
Soergelia		yes				yes		yes		

Table 3. An analysis of the genera of the North American family Felidae from the Paleobiology Database. The order of the genera is the same as the order in Ross's supplemental information.[26]

Genus	NA	NA	SA	SA	Asia	Asia	Europe	Europe	Africa	Africa
	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.
Pseudael.	yes				yes	yes	yes		yes	
Nibravides	yes									
Adelphail.	yes									
Felis	yes	yes			yes	yes	yes	yes	yes	yes
Machairod.	yes				yes		yes	yes	yes	
Lynx	yes	yes			yes	yes	yes	yes	yes	yes
Meganter.	yes				yes	yes	yes	yes	yes	yes
Dinofelis	yes				yes		yes		yes	yes
Homother.	yes	yes		yes	yes	yes	yes	yes	yes	yes
Miracinon.	yes	yes								
Panthera	yes	yes			yes	yes	yes	yes	yes	yes
Smilodon	yes	yes		yes						
Acinonyx					yes	yes	yes	yes	yes	yes
Leopardus		yes		yes						
Paramach.	yes				yes	yes	yes			

Table 4. An analysis of the genera of the North American family Gomphotheriidae from the Paleobiology Database. The order of the genera is the same as the order in Ross's supplemental information.[26]

Genus	NA	NA	SA	SA	Asia	Asia	Europe	Europe	Africa	Africa
	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.	Tert.	Pleist.
Cheoroloph.					yes		yes		yes	
Protanancus					yes				yes	
Eubelodon	yes									
Gomphoth.	yes	yes			yes	yes	yes	yes	yes	
Platybelod.	yes				yes				yes	
Amebelod.	yes						yes			
Rhynchoth.	yes	yes								
Cuvieronius	yes	yes	yes	yes						
Stegomast.	yes	yes								

are no longer reported from North America, while Ross had *Machairodus*, *Megantereon*, and *Paramachaerodus* in the Pleistocene, but these have been eliminated in the Paleobiology Database. In Gomphotheriidae (table 4), *Cheorolophodon* and *Protanancus* are no longer listed in the database. One Canidae genus, seven genera of Talpidae, and five Rhinoceratidae genera have been deleted from North America. That is 25 genera out of 205, or 12%. I assume that these differences are due to the subjectivity involved in taxonomy or in assigning dates/levels in the geological column.

So, some heretofore North American Tertiary and Pleistocene mammal families and genera are not unique to North America. Mammals dispersed across several other continents, where *their* dead pre-Flood ancestors are often found in the Tertiary strata below, as would be expected during post-Flood dispersal. Therefore, the distribution of mammals buried in the Flood and those that spread from the Ark to North America is not unique. Ross's conclusion does not negate a Late Cenozoic Flood/post-Flood boundary. And since this analysis also assumes that the Pliocene/Pleistocene boundary is globally synchronous in biblical history, it fails to address the more plausible proposal that the post-Flood boundary is *broadly* Late Cenozoic, but can vary with respect to geologic column classifications from area to area.

Why did non-North American baramins not migrate to North America?

Ross also questions why some baramins from other continents did not come to North America:

> "Lastly, and perhaps most damaging: why are there no post-flood mammal migrants into North America, the Flood derived fossils of which are otherwise only known from India? Or Africa? Or Australia? The latter is the most damaging case, as the fossil record of mammals in Australia is the most unusual, being dominated by an extensive array of marsupials. Yet, there are no fossil kangaroos, koalas, or Tasmanian wolves in North America *or any other continent.* They are not present anywhere else in Pleistocene deposits, or indeed in any other Cenozoic deposits on any of the other continents [emphasis original]."[27]

Although genera that are found as Tertiary fossils from other continents did spread to North America (tables 2–4), the question of why the marsupials (except the opossum), did not appear to migrate to North America is indeed a mystery. But the mystery holds also for advocates of the K/Pg boundary position. There are many biogeographic mysteries to be solved. Again, reliance on fossils alone leads to weak interpretations, and new discoveries added in the most recent lists in the Paleobiology Database continue to change the picture.

What about the same genera before and after the Flood?

There still are some boundary-crossing genera in North America, as well as on other continents, assuming the boundary is the Pliocene/Pleistocene. During the differentiation of the kinds (assumed at the family level) after the Flood, we would, at first glance, not expect identical genera both pre- and post-Flood because of genetic reshuffling. However, it still needs to be proven that the same genera could not occur both before and after the Flood. Besides, one would expect a certain level of variability within each genus. So, the same genus in the biological classification system does not mean identical morphology both before and after the Flood, although it can be similar (which is why they would place the organisms into the same genus). This is a biological question that needs further analysis.

Regardless, such equivocal fossil evidence should not be the sole criterion to determine the Flood/post-Flood boundary, especially in the light of several dozen factors showing that the boundary is in the Late Cenozoic. Advocates of the K/Pg boundary position need to analyze these several dozen factors in depth.

Conclusion

Ross's argument for a K/Pg boundary is not conclusive. It depends on the powerful assumption of a one-to-one correspondence between uniformitarian time markers and biblical history. It depends on such a correspondence being globally synchronous. It ignores the different climate that existed in the early post-Flood period. It ignores fossil data from other continents. Many families and genera were not unique to North America in the Tertiary or Pleistocene. Most of the Ice Age mammals would have been able to cross the Bering Land Bridge early on. Moreover, 5% of new families and/or genera have been added to the database of North American mammals, while 12% of North American mammals earlier listed in the Paleobiology Database for the Tertiary and/or Pleistocene have been removed from the database. The challenge of why unique mammals from other continents, such as the Australian marsupials, did not migrate to North America after the Flood is the same for either boundary model. And just because the same genera are found in both the pre-Pleistocene and Pleistocene it does not mean that these presumed boundary crossing genera are exactly the same because of the variability in each genus. It still needs to be proven that similar genera cannot exist both before and after the Flood. Such equivocal fossil evidence should not be used to negate several dozen other more soundly based factors that point to a Late Cenozoic boundary.

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A more biblical cosmology

D. Russell Humphreys

Genesis 1 contains three strong clues that the speed of light in the heavens was extremely high during the first four days of creation. Relativity says the speed of light controls the 'speed of time'. Earth days were of normal length (Exodus 20:11), so the speed of light on Earth was normal. The high speed of light in the heavens means that billions of years' worth of events would occur there before the end of the fourth day on Earth. If at that time the speed of light in the heavens dropped suddenly to normal, then we would see no difference between things closer or farther than 6,000 light-years away. The heavens would have an apparent history of billions of years, allowing them to declare the glory of God (Psalm 19:1).

1. Introduction

Taking the Hebrew text of Scripture at face value, without inserting gaps or revising the meanings, the universe is only about 6,000 years old. Creationists have proposed various theories to explain how we could see distant heavenly bodies with such a short time available for the light to get here. Creationist cosmologies should also explain three other observed features of the universe: (1) the increasing red shift of light with increasing distance, (2) the Cosmic Microwave Background radiation, and (3) the seemingly great age of the distant cosmos (see figure 7 for an example of such data). Some creationist theories only explain a few of these additional features.

Many of the recent theories build on Einstein's general theory of relativity, particularly the idea of gravitational time dilation. I have offered two such theories myself, one in 1994[1] and one in 2008.[2] But I have never been satisfied with such theories, even my own, because they did not rest upon a firm biblical foundation. Most of the authors, including myself, seem to have first gotten a physics idea and then tried to see if the idea could fit into Scripture. In this paper, I am mainly pointing out what God says He did, especially in the first chapter of Genesis. Along the way I will point out a few of the scientific consequences. I will not try to develop the physics (if it was not completely miraculous) of how He did what He said, but this paper may give a basis for later research into that question. Some elements of my first two cosmologies may surface at that point. One element, the idea that the earth is approximately at the centre of the cosmos, is remaining here.

2. The first day

The first line of the Bible tells us:

> "In the beginning God created the heavens and the earth" (Genesis 1:1).

Right away, we must grapple with a difficulty (it will not be the last one) for many people: does 'heavens' here mean the sun, moon, and stars, or the *space* that will later contain those bodies? I vote for 'space', first because chapter one says God made the heavenly bodies at a later time, on the fourth day.[3] Secondly, because many Scriptures[4] refer to the heavenly bodies specifically as 'the host of heaven'. Third, if 'the heavens', in verse 1, were to include the heavenly bodies, then that verse would have to become a summary statement covering the whole chapter. Then there would be no verse specifically describing the creation of the earth, which pops up suddenly in the second verse. Having 'the heavens' in verse 1 mean 'space' seems to make the narrative more straightforward. Other creationists take different views of this verse.[5,6] Their views would not affect the main points I make here. The next verse reads:

> "And the earth was formless and void; and darkness was on the face of the deep. And the Spirit of God moved on the face of the waters" (Genesis 1:2).

According to one of my favourite lexicons, the most general meaning of the Hebrew noun *t*^{e}*hom*, translated 'deep', seems to be 'a large body of water'.[7] This is consistent with the last part of the verse, 'the face of the *waters'*. The face (surface) of the deep is the interface of the waters with the heavens. Within the deep is the earth. The earth could be 'formless and void' (or 'unformed and unfilled'[8]) simply by being scattered atoms (unconsolidated into a solid) within the water, or it could simply be an unmarked region of water within the deep which God would later transform into the solid earth, on the third day.

To read Scripture straightforwardly,[9] I take the water of the deep to be ordinary liquid water, not ice, or steam, or hot plasma, or other materials, as some creationists propose. There are good Hebrew words for those alternatives. For example, several Hebrew words for 'fire' would be good for 'plasma'. Yet God did not use any of the alternative words,

so I suggest that He really did mean H_2O molecules in the liquid state.

The Spirit of God moving 'on' (or over, or above, Hebrew, *'al*) the face of the waters suggests that there was an 'up' and a 'down'; i.e. gravity was working even at that early stage of creation. In an otherwise empty space, the self-gravity of the mass of water would pull it into a spherical shape, even if God had not created it that way at the outset. So the deep was, or became, a ball of water.[10]

The next three verses tell us the darkness did not continue:

> "And God said, 'Let there be light'; and there was light. And God saw that the light was good, and God separated the light from the darkness. And there was evening and there was morning, one day" (Genesis 1:3–5).

Taking the account at face value, the source of this light could not have been the sun, because the sun, along with the other heavenly bodies, was not made until the fourth day. (There is no physical requirement for the light source, or sources, to have been a sun; light can have a lot of different kinds of source.) My picture of what happened is this: the light first shone on the deep from all directions, and then it shone from only one direction. A psalm which appears to refer to the days of creation supports this:

> "Covering Yourself with light as with a cloak …" (Psalm 104:2).

In other words, God could have gathered the light around Himself and become a localized source for the light, as He will do in the future.[11] The deep, now being illuminated from only one direction, has a dark side and a light side. This is my suggestion for how God "separated the light from the darkness".

As soon as the light and dark sides appear, the deep appears to be rotating. If we were to drop a marker buoy on the surface of the waters, it would take a period of time to be rotated completely around the sphere. That would mark off an evening and a morning, and God called the period, 'one day'.[12]

A part of the Ten Commandments tells us how long those rotation periods were:

> "For in six days the Lord made the heavens and the earth …" (Exodus 20:11).

Surrounding this verse are verses using the same word translated 'day' (Hebrew *yom*) to mean an ordinary-length day of the week, such as, "Six days you shall labor … but the seventh day is a sabbath … ."[13] Nowhere in the passage does God use the Hebrew words or phrases for 'long age' (*'olam*), "to a thousandth generation" (*l*^{e}*eleph dor*), or "thousands of myriads" of years (*alephei revavot shanim*). Since we know that God is very precise in His use of words,[14] we can take Him at His Word to mean that the entire period (as measured on Earth) in which He made the universe was six ordinary-length days of the week. Time on Earth during Creation Week proceeded at its normal rate. As I will explain in the seventh section, the speed of light is directly connected to the 'speed of time'. So the normalcy of time on Earth means the speed of light on Earth during the first six days was at its normal value, 186,000 miles per second, or 300,000 km/sec.

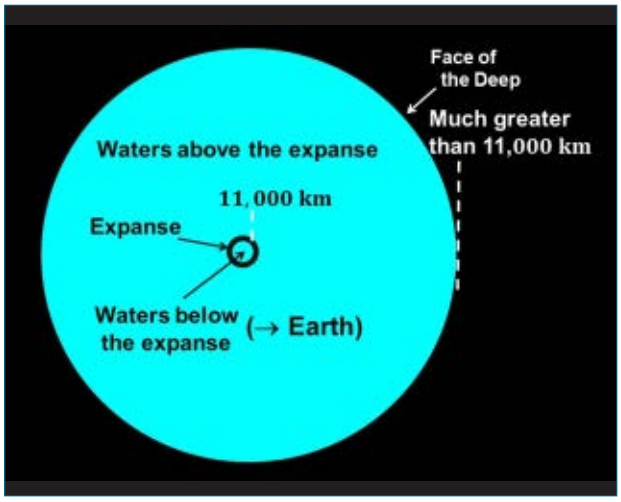

Figure 1. "In the midst of the waters" implies the expanse was near the centre of the deep.

3. The second day

Next, we have a verse that is especially important in building a cosmology:

> "And God said, 'Let there be an expanse in the midst of the waters, and let it separate the waters from the waters'" (Genesis 1:6).

The Hebrew word *raqia'*, translated 'expanse',[15] is a very unusual one to find in this context. Its most literal meaning seems to be *something solid spread out by hammering thin*.[16] Examples of that usage (and of the associated verb *raqa'*) are: copper or bronze being hammered out into sheets to plate the altar of sacrifice,[17] gold being spread out on an idol,[18] gold being hammered out into thin sheets to be cut into gold threads,[19] and silver being beaten into plates.[20] In verse eight, God calls the *raqia'* 'heavens'. For millennia, scholars appear to have worried about the literal meaning, apparently thinking they must somehow reconcile a nearly two-dimensional solid and a three-dimensional seemingly empty space. More recently, scholars who take a low view of the accuracy of Scripture have claimed that God was merely 'accommodating' ideas of the ancient Near East by presenting the heavens as a thin metal dome above the earth.[21] More conservative scholars have sought to find wider meanings of *raqia'*, such as 'expanse'.[5, 22]

I suggest that the scholars have been making problems for themselves by (1) thinking the heavens have only *three* dimensions, and (2) thinking that solids are always *impenetrable*. There is Scriptural and scientific evidence that space is, or is filled with, a solid material which is thin in a fourth spatial direction.[23] We cannot perceive our motion through the solid (or its motion through us), nor can we (usually) perceive the fourth direction.[24]

So my proposal is that the *raqia'* is a solid physical material which God hammered thin in one of its four dimensions, causing it to expand in its three larger dimensions. Thus, the Hebrew word suggests that at some time *the expanse was expanded*. The rest of Genesis 1 will show that the expansion was enormous and fast, taking place over the second through to the fourth days at the longest.

There is another cosmologically significant phrase in the above verse: "in the midst of the waters". In Hebrew, the phrase is *b^{e}tok*, which is the preposition *b^{e}*, 'in', combined with the noun *tavek*, the primary meaning of which is 'midst, middle'.[25] With the preposition, it means, "in the very heart and midst of".[26] Examples are "the tree of life in the midst of the garden",[27] and "the tree in the midst of the garden".[28] So the *raqia'* was near the centre of the deep, as figure 1 shows. It was not quite at the centre, because there were waters below the *raqia'* which God transformed into the solid earth on the third day.[29]

Many people, including myself at one time, have pictured the deep as being much smaller, a relatively thin skin (an ocean) a few miles deep atop a solid earth of the same size as it now is. They, and I at one time, have imagined the *raqia'* as being the earth's atmosphere, dividing the deep into roughly equal parts, the waters above and the waters below. The waters above, a canopy of water vapour, would later collapse upon the earth, furnishing much of the waters of the Genesis Flood.[30] But I found there were problems with that picture:[31]

1. Later on in the account,[32] on the fourth day, God says three times that He placed the heavenly bodies "in the expanse (*raqia'*) of the heavens". This implies that by the fourth day, the *raqia'* was much larger than the atmosphere, large enough to contain all the stars. If the canopy theory were correct, it seems that it would have been clearer for God to say He placed the heavenly bodies above (different Hebrew preposition) the *raqia'*, or even more clearly, "above the waters above".
2. The waters above the expanse still exist, according to a psalm written long after the Genesis Flood: "Praise Him highest heavens, and the waters that are above the heavens."[33] Therefore those waters could not have been a vapour canopy which collapsed upon the earth during the Flood. Instead, it appears they are now a much higher canopy of water beyond the most distant galaxy.
3. I think there is a better word than *b^{e}tok* ('in the midst') to describe the idea of a thin, spherical *raqia'* dividing a thin, spherical shell of waters into two thinner parts. That word is *chatsi* (pronounce *ch* as in 'chaos'), meaning 'divided', 'half', or 'halfway'.[34] An example is in Exodus 27:5, where a horizontal bronze net was placed halfway up the bronze altar, dividing it into upper and lower parts. The fact that God did not use this word in Genesis 1:7 is evidence against the canopy theory's picture of a thin deep being divided into two thinner parts.

So, I am persuaded that figure 1 is the correct view. On the third day, the waters below the expanse turn into the solid earth, as suggested by 2 Peter 3:5.[35] The present radius of the earth is about 6,400 km. If God conserved mass during the transformation, then on the second day, the radius of the waters below the expanse would have been about 11,000 km.[36] We do not know how thick the expanse was initially, but to make the relative dimensions more definite, let us assume it was less than 100 km. So, in order for the expanse to have been "in the midst" (i.e. near the centre) of the waters, the outer radius of the waters would have to have been very much greater than 11,100 km. Let us say it was at least 10 times greater, 110,000 km at the least.

Later on, I am going to offer a theoretical reason for thinking the mass of the deep was greater than the total mass of all the stars in all the galaxies the Hubble Space Telescope can observe. That would mean that the radius of the deep was at least one light-year,[37] about 10 trillion km. That is 1,700 times bigger than our solar system. It is billions of times smaller than the observed cosmos is today, but it is still a great distance, about one quarter the distance to the nearest star. So if my yet-to-be-explained theory is right, the deep was enormously deep!

4. The fourth day

The next item of cosmological significance is on the fourth day:

> "Then God said, 'Let there be lights in the expanse of the heavens … and let them be for lights in the expanse of the heavens … .' God made the two great lights … and the stars. God placed them in the expanse of the heavens …" (Genesis 1:14–17).

It is significant that God repeated this exact phrase, "in the expanse of the heavens", three times, probably so we would not miss it. All the words are important: 'in', not 'above'; 'the expanse', so we would know it is the same *raqia'* He made on the second day; 'of the heavens', so we would not miss the identification He had made between the *raqia'* and the heavens. The above verses tell us that by the fourth day the expanse was big enough to contain all the stars. The

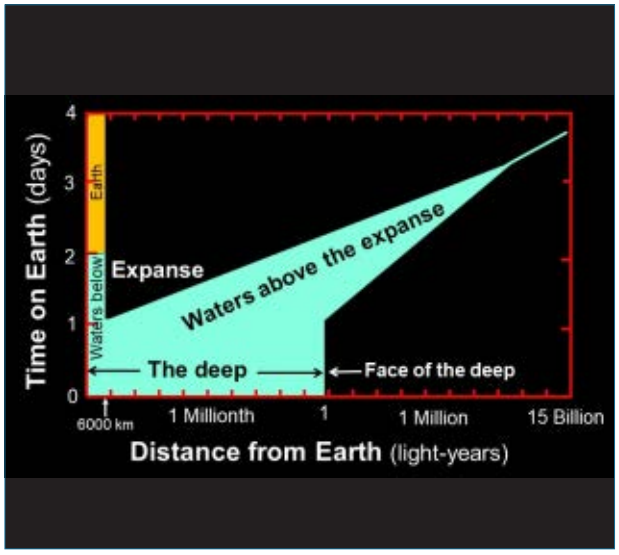

Figure 2. Expanding the expanse and raising the waters.

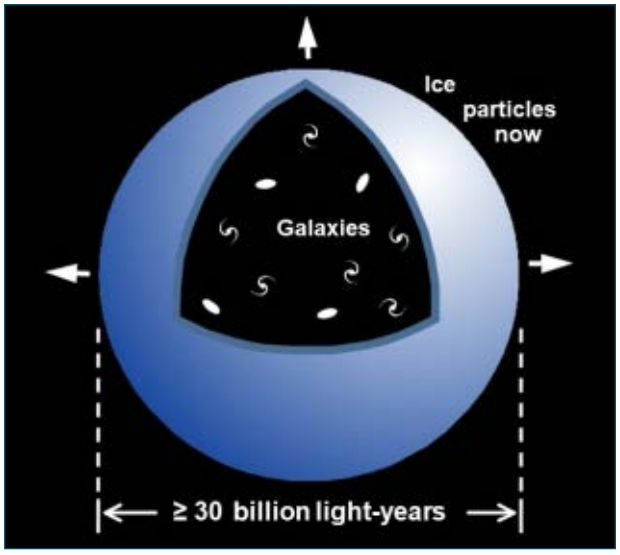

Figure 3. The waters above the heavens should be very tenuous. Planet-sized bodies would be water covered with ice; smaller bodies should be only ice by now.

psalm I mentioned in the third section, point (2), says that there are waters above the expanse:

> "Praise the Lord! Praise the Lord from the heavens; praise Him in the heights! Praise Him, all His angels; praise Him all His hosts! Praise Him, sun and moon; praise Him all stars of light! Praise Him, highest heavens, and the waters that are above the heavens!" (Psalm 148:1–4).

So, between the second day and the fourth day (on Earth), the top of the expanse and the waters above the expanse expanded outward enormously.[38] Let us put numbers to the amount of expansion. The light from the most distant object yet observed is estimated to have travelled about 13.5 billion light years across expanding space to get to us.[39] The waters were above the object. So at present, the waters above the expanse have to be at a greater distance, say at least 15 billion light years. (It could be much greater.)

Figure 2 shows, in a simplified way, the expansion of the expanse and the raising of the waters above the expanse. The horizontal axis shows the distance from Earth's centre on a very compressed (logarithmic) scale, going from a few kilometres on the left out to 15 billion light-years on the right. (Remember that a light-year is a unit of distance, about 10 trillion km.) The vertical axis is the time after creation as measured on Earth, from zero up to 4 days.

From creation to 1 day, the face of the deep stays at 1 light-year, after which it begins moving outward. The blue triangle represents the waters above the expanse moving outward and getting thinner as they are spread over a wider and wider area. They reach 15 billion light-years late in the fourth day. The sides of the triangle would not be straight as I have shown for simplicity; in reality, they would be curved.

To keep the volume and mass of the water constant during the expansion, the *average* thickness of the waters late in the fourth day would have thinned out to only 0.015 mm, having been spread out over an enormous area. During the expansion, the waters would have been pulled apart to form widely separated bodies of assorted sizes, from planet-sized on down to small sizes. The larger bodies would have ice exteriors and water interiors; the smaller bodies would be all ice by now. So in figure 3, the waters above would be far more tenuous and widely spread than the rather solid-looking shell I must show for purposes of illustration. If our telescopes were eventually able to see out that far, the waters above would probably be too tenuous to detect. We would merely see that there were no more galaxies beyond it.

5. The speed of the expansion and the speed of light

Now let us do a simple calculation of how fast the top of the expanse and the waters above the expanse moved. They moved outward (riding above the expanding *raqia'*) at least 15 billion light-years within three ordinary-length days on Earth, so their average velocity, v, as measured by time on Earth, would have been at least:

$$v \geq \frac{15 \times 10^9 \text{ light–years}}{3 \text{ days}} = 5.5 \times 10^{17} \frac{\text{km}}{\text{sec}}. \quad (1)$$

That number is 1.8 trillion times the normal speed of light, 300,000 km/sec. If God desired to accomplish this extremely fast movement in the heavens according to the same laws

of physics that He has given us for today (keep in mind that He was under no obligation to do so), He could have set the value of c (the speed of light in a vacuum and zero gravity) in those laws at least 1.8 trillion times higher than what we regard today as normal. This high value of c would have existed *in the heavens* during the first four days. As I said at the end of the second section, Scripture implies that *on Earth,* c had its normal value during Creation Week.

I can only guess at how God controlled c. The speed of light is determined by the properties of the space[40] through which it moves, so I think God controlled those properties, probably miraculously. I showed in another publication[41] how c could be determined by the tension, τ, and the mass density, ρ, of space:

$$c = \sqrt{\frac{\tau}{\rho}} \qquad (2)$$

In another section of that publication, I derived from my model the present mass density of space, an exceptionally large number that is consistent with modern estimates of the density of the quantum vacuum.[42] It is possible that God varied that density, perhaps miraculously, perhaps by a thermodynamic state change (as between liquid water and ice), which may have also been miraculous.

The important thing to keep in mind is that, regardless of physics speculations, the biblically stated fast expansion of the expanse implies an extremely high speed of light in the heavens, as measured by time on Earth.

In the Day 4 account, there is another indication of a high speed of light in the heavens as measured by time on earth:

> "… and let them be for lights in the heavens to give light on the earth; and it was so ... there was evening and morning, a fourth day" (Genesis 1:15, 19).

God made the lights (sun, moon, planets, and stars) during the fourth day. The "and it was so" implies that, somehow, God got the light to Earth before the end of the fourth day. A high speed of light in the heavens would accomplish that.[43]

We can set a better lower limit for the value of c in the heavens than eq. (1) allows by noting that the stars became luminous on the fourth day and that the light from the most distant galaxy reached Earth within the same day:

$$c \geq \frac{15 \times 10^9 \text{ light–years}}{1 \text{ day}} = 1.6 \times 10^{18} \frac{\text{km}}{\text{sec}} \quad . \qquad (3)$$

That is more than 5.5 trillion times the normal speed of light.

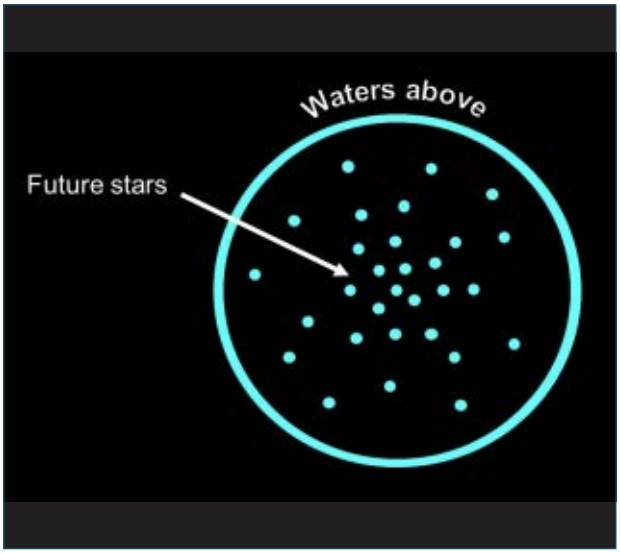

Figure 4. Balls of water of various sizes left behind as the waters above the heavens rolled outward

6. Theory: balls of water stayed behind

Some readers might be wondering, "Why would God go to all the trouble of expanding the expanse and the waters above it? Why not simply make them big to begin with?" My theory is that he wanted all the heavenly bodies to be made from the waters of the deep. I favour this view because I have another theory: that God made the magnetic fields of the heavenly bodies by creating them as water to begin with, and by creating the hydrogen nuclei in that water with their spins all pointing in the same direction. That produces a magnetic field strong enough to explain the presently observed magnetic fields of the bodies. The magnetic fields would preserve themselves as God transformed the bodies into the materials of which they now consist.[35] This theory has had remarkable success in explaining and predicting the strengths of the magnetic fields of solar system bodies and stars.[44]

I am suggesting that as God rolled the waters outward ahead of the expanse, He left behind various-sized balls of water, as figure 4 shows. Then on the fourth day He transformed (miraculously, I think) the water into planets and stars. The light from the stars would have its wavelengths shifted toward the red side of the spectrum due to the expansion of the expanse continuing through the fourth day.[45] The amount of redshift would be proportional to the distance the light travelled through the expanding expanse.[46] This would explain the redshift-distance effect observed in the spectra from galaxies.

Since the water had an initial temperature, and since the *raqia'* also must have had an initial temperature, there

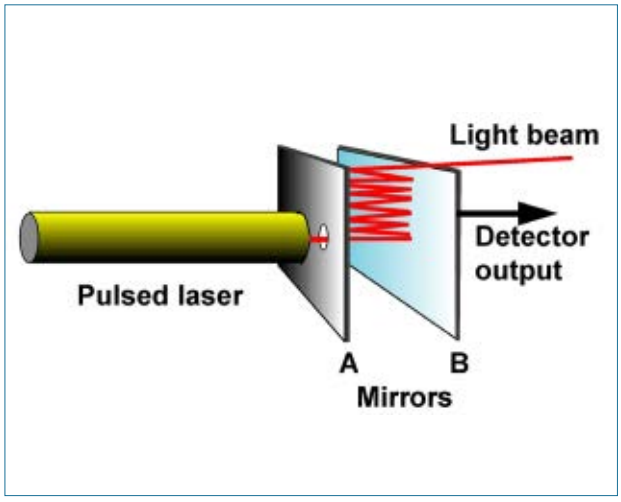

Figure 5. Light-and-mirror clock

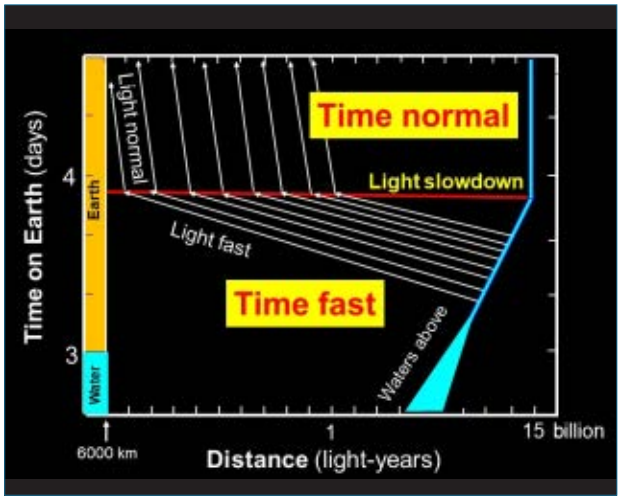

Figure 6. Light paths, shown as straight for convenience, with instant slowdown

is a possibility that the Cosmic Microwave Background is simply red-shifted thermal radiation from either one of those materials.[47]

For this theory to work, the initial radius of the deep would have to be one or more light-years, in order to account for the mass of all the galaxies observed in the cosmos, as I remarked at the end of the third section.

7. The speed of light and the speed of time

One of the simplest clocks we can imagine is a light beam bouncing between two mirrors, figure 5.[48] This clock ticks with a frequency, f, that depends on the mirror spacing, d, and the speed of light, c, in the space between the mirrors:

$$f = \frac{c}{2\,d} \quad . \tag{4}$$

If the spacing stays constant and the speed of light changes, the frequency of the clock will change in direct proportion to c. This clock is typical of all the clocks we could make based on any physical process: atomic vibrations, orbiting planets, nerve impulses in the brain, etc., because the rates of all physical processes appear to depend on the speed of light.[49]

So, during the first four days in deep space, where the speed of light was trillions of times higher (as measured by clocks on Earth) than normal, the light from atoms would have had trillions of times greater frequency (as measured by Earth clocks), and planets would have orbited trillions of times faster (as compared to the earth in its orbit). Yet if we had been out there in deep space during the first four days (as measured on Earth), all physical processes would have appeared to be happening at their normal rates. The cosmos would appear to have had a history of billions of years, as measured by the fast clocks out in deep space. If we measured the speed of light out there with clocks out there, the speed would be just 300,000 km/sec. Looking back to the earth, it would appear to be almost completely stopped, both in its rotation and its orbit (assuming the speed of light has always been normal within the whole solar system).

So, since the speed of light controls the 'speed of time', billions of years' worth of events would take place in the heavens within four ordinary-length days on Earth, as I remarked at the end of the second section. As far as I can see, this is an inevitable consequence of the high speed of light in the heavens that the Genesis 1 account implies.

8. The great slowdown

Today, the speed of light in the cosmos appears, by all our observations, to be the same as it is here on Earth. So, at some time, God would have dropped the speed of light in the heavens to normal. I propose that He did this instantaneously throughout the cosmos late on the fourth day. It is possible, of course, that He did it non-instantaneously, at different times in different places, but that possibility is harder to analyze and may have fewer benefits than the first.

Figure 6 shows the main consequences of an instant slowdown everywhere. Again, the horizontal axis shows distance from Earth on a very compressed scale. The vertical scale is the time after creation as measured on Earth, from 2.7 days up to 4.6 days. Again, the blue triangle at the lower right represents the waters above the expanse moving outward and getting thinner.

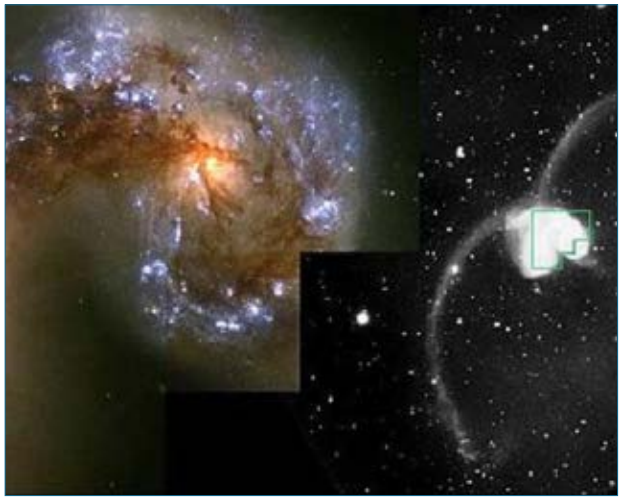

Figure 7. The Antennae Galaxies took millions of their years to collide. (Image Credit: Hubble Space Telescope, NASA.)

Figure 8. The Whirlpool Galaxy, NGC 5194, 31 million light-years away (Image credit: Hubble Space Telescope, NASA)

The horizontal red line represents the instant God slows light down several trillionfold (as measured with Earth clocks). The slanting lines labelled 'light fast' represent the paths of pulses of light from a regularly pulsing star near the bottom of the waters above. If I could show things on a much finer scale, the slanted lines could represent the paths of wave crests from a single atom emitting light at a constant frequency. When the white lines hit the red line, they increase their slopes in accordance with the new, slower speed of light. The horizontal distances between each white line (representing, for example, the wavelength of light from an atom) stay the same. (Imagine a line of pulses all moving at a high speed, and then instantly all slowing to a lesser speed; the distance between the pulses will stay the same.) In accordance with the simple relation between the frequency, f, the wavelength, λ, and the speed of light, c:

$$f = \frac{c}{\lambda}, \qquad (5)$$

the frequency of the light will decrease.[50] (Imagining again the line of pulses now travelling slower—they will successively hit the earth at a lower frequency, with longer time intervals between them.) In all this, I am talking about frequency and speed as measured with Earth clocks. As measured with clocks in deep space, the frequencies of atoms and the speed of light would be normal. So the frequencies of atoms in deep space would be high if we could measure them with our clocks on Earth, but after the great slowdown, the frequencies we receive would be normal.

The bottom line is that the instantaneous slowdown of light guarantees that stars beyond 6,000 light-years from us would look exactly the same as closer stars. It is as if there were a spherical window 6,000 light-years away from us[51] through which we can see more distant objects perfectly well. It is perfectly transparent. As seen by us, the distant objects would behave normally (for example, the periods of binary stars would be normal), but they would appear to have had a longer history than 6,000 years. The events we observe at great distances would really have happened. As far as I can tell, all the laws of physics would transform in lockstep with the speed of light, so that we would not see a difference.[52]

9. The rotation of the deep

I have not yet spoken about the third clue (in my abstract) in Genesis 1 for a high speed of light in the heavens for the first four days. In the second section of this paper, I commented that as soon as the light and dark sides of the deep appear, the deep appears to be rotating, and that God uses this rotation to mark off 'one day' in Genesis 1:5, as measured at the centre of the deep, where the earth will be on the third day.[53] This definition would be unambiguous if the deep rotated as a whole, with the same angular velocity, ω. The (classical, but maybe not much different for relativistic calculations) peripheral velocity, $v(r)$, of the water at a distance, r, from the rotation axis would be:

$$v(r) = \omega r\,. \qquad (6)$$

For a rotation period of one day (Earth time), $\omega = 2\pi$ / (1 day) = 7.3 x 10^{-5} radian/sec. For the surface of the deep at the equator, let us take r = 1 light-year = 10^{13} km. That gives us a peripheral velocity of 730 million km/sec, about 2,400 times the normal speed of light. In order for the normal laws of physics to be in operation, the speed of light at that distance had to have been greater than that value. I suggest

that, in order to have no physical discontinuities in the deep, the speed of light (as measured by Earth's clocks) increased smoothly with increasing distance from the earth. So the rotation of the deep gives us some insight into the transition with distance from a normal speed of light on Earth to a high speed of light out in the cosmos, during the first four days.[54]

Conclusion: why God did it that way

Why would God have wanted to have fast light and fast time out in the cosmos during the first four days? A well-known psalm says He intended the heavens to be a showcase for His glory:

> "The heavens are telling of the glory of God; and their expanse is declaring the work of His hands" (Psalm 19:1).

He evidently wanted Adam and Eve to see that glory on the sixth night. They would see a lot of stars, the Milky Way, and perhaps even the Andromeda galaxy, visible to the naked eye on clear dark nights as a faint patch in the northern sky. The nearest star is four light-years away; parts of the Milky Way are 50,000 light-years away; and Andromeda, our nearest neighbour galaxy in the northern hemisphere, is about two million light-years away. God did not want our first parents to wait for years to see the nearest star. Fast light for most of the way and then arriving on Earth by the end of the fourth day was a way for Him to present the whole night sky to their view.

As for time being fast in the distant cosmos, I think He wanted us to see how things developed in the distant sky. Big objects like galaxies take billions of years to mature. See figure 7.[55] From what we see out there, we can deduce a lot of the laws of physics that He set up. That glorifies Him, too. He gave us some hints in Scripture that time was fast in the heavens:

> "So that your days may be multiplied … as [the] days of the heavens above the earth" (Deuteronomy 11:21, from the Hebrew).
>
> "… and his throne as [the] days of [the] heavens" (Psalm 89:29, from the Hebrew).
>
> "… that [the] heavens existed from long ago …" (2 Peter 3:5, from the Greek).

So the heavens are ancient (as measured by their clocks), even though they are actually young (as measured by Earth clocks—the ones God set up to delineate time for us[56]). The issue of time has prevented many people today from appreciating the Author of the beauty and power on display in the night sky. I want this paper's exploration of what Scripture says, about how God built His cosmos, to help every person be in awe of God's glory and handiwork in the heavens, of which figure 8 is a small sample.

References

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2. Humphreys, D.R., New time dilation helps creation cosmology, *J. Creation* **22**(3):84–92, 2008; creation.com/new-time-dilation-helps-creation-cosmology+.
3. Genesis 1:14–19.
4. Genesis 2:1, Deuteronomy 4:19, Nehemiah 9:6, Isaiah 34:4, etc. Host = army. Sometimes 'the host of heaven' means the angelic army, and sometimes 'the heavens' means both space and the heavenly bodies in it, so 'the host of heaven' part of my argument is not ironclad.
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6. Fouts, D.M., *Right from the Start! Calling evangelical leadership to faith in Genesis 1–2*, Amazon Services, self-published, 2015.
7. Harris, R., Archer, G. L., and Waltke, B.K. (Eds.), *Theological Wordbook of the Old Testament*, Moody Press, Chicago, IL, vol. 2, p. 965, 1980. In some cases, *tᵉhom* appears specifically to mean 'ocean'; in others, 'underground waters', but these cases are included in the general meaning, 'large body of water'.
8. Fields, W., *Unformed and Unfilled: A critique of the gap theory*, Master Books, Green Forest, AR, 2005. This book gives good Scriptural evidence that there is no gap of time between the first two verses of chapter one.
9. Humphreys, ref. 1, pp. 55–57.
10. We have no way of knowing whether gravity was as strong then as it is today. If God made it strong later on in the week, it could simplify things.
11. Isaiah 60:19–20; Revelation 21:23, 22:5. Notice that the Spirit of God apparently localized Himself in Gen 1:2. Also note that many other verses in Psalm 104 refer to specific events.
12. Scholars have long debated why God said 'one day' (which is how the Hebrew reads) instead of 'first day' (which is how some translations mistakenly put it), in contrast to 'second day' (Genesis 1:8), 'third day' (Genesis 1:13), etc. But some scholars suggest that He was setting forth the definition of a day, namely one full rotation of the deep (and later the earth). See Steinmann, A.E., אֶחָד [*echad*] as an ordinal number and the meaning of Genesis 1:5, *J. Evang. Theol. Soc.* **45**(4):577–584, 2002.
13. Exodus 20:9–10.
14. Psalm 12:6.
15. In the LXX, *stereoma* (something firm, hard, solid, strong); in the Vulgate, *firmamentum* (something firm, strong, stout), which latter Wycliffe simply transliterated as 'firmament'. The King James scholars followed Wycliffe's lead, making the word well-known in English.
16. Harris, ref. 7, pp. 861–862.
17. Numbers 16:38–38 in English versions; Numbers 17:3–4 in the Hebrew text.
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24. It is not neccessary that the original readers recognize a fourth spatial dimension or that the *raqia'* could be a solid. They could, however, observe that many heavenly bodies apparently move freely through the *raqia'*.
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28. Genesis 3:3.
29. Genesis 1:9–10.

30. Dillow, J.C., *The Waters Above: Earth's pre-Flood vapor canopy*, Moody Press, Chicago, IL, 1981.
31. Humphreys, ref. 1, pp. 58–65.
32. Genesis 1:14, 15, 17.
33. Psalm 148:4.
34. Harris, ref. 7, vol. 1, p. 313.
35. In 2 Peter 3:5, "the earth was formed out of water and by water", the word translated 'formed' is from the Greek verb *sunistēmi*, which can mean 'to put or place together'. That suggests to me that God took apart the atoms and nuclei of the water molecules, re-assembled them into other atoms and nuclei, and then assembled those into molecules, minerals, rocks, etc. Humphreys, D.R., The creation of the earth's magnetic field, CRSQ **20**(2):89–94, Sep 1983; p. 90; see creationresearch.org/crsq-1983-volume-20-number-2_the-creation-of-the-earths-magnetic-field .
36. Estimate based on the average density of the earth and the density of uncompressed water.
37. Humphreys, ref. 1, p. 70.
38. I suggest that this expansion is the stretching out and spreading out of the heavens mentioned in Job 9:8, Psalm 104:2, Isaiah 40:22, Jeremiah 10:12, Zechariah 12:1, 2 Samuel 22:10, Job 37:18, Psalm 18:9; Psalm 144:5, Isaiah 42:5, Isaiah 44:24, Isaiah 48:13, Isaiah 51:3, Jeremiah 51:15, and Ezekiel 1:22.
39. Bryner, J., Astronomers just discovered the farthest object in the known universe—but what is it? *Live Science Newsletter*, 7 April 2022, livescience.com/farthest-astronomical-object-ever-seen. The object may be a massive galaxy. The estimated distance depends somewhat on which cosmological model one uses, but I have no doubt that it is truly many billions of light-years.
40. The 'quantum vacuum', see ref. 23 and the comments in that part of the third section.
41. Humphreys, ref. 23, eq. (9).
42. Humphreys, ref. 23, eq. (15). Section 4, item 5 of that paper offers a reason that the high mass density of space would not be detectable gravitationally.
43. Thus, the speed of light in the heavens would be high going both from and to the earth. This is distinct from some creationists' ideas, which concern a possible difference in the speed of light in different directions.
44. Humphreys, D.R., The creation of cosmic magnetic fields, in *Proceedings of the Sixth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 213–230, 2008; see digitalcommons.cedarville.edu/icc_proceedings/vol6/iss1/20/.
45. Humphreys, ref. 1, pp. 120–122.
46. In conventional theory, the 'cosmological' redshifts are due to the stretching of space (or distances) as the light travels to us. Doppler redshifts due to the motion of the emitting objects with repect to the space in their locality simply add to the cosmological redshifts, as do gravitational redshifts.
47. Humphreys, ref. 23, sect. 5.
48. Humphreys, ref. 2, pp. 86–87.
49. Process rates depend on the four fundamental forces of physics, electromagnetism, gravity, and the strong and weak nuclear forces. The electromagnetic force depends on the permittivity, ε_0, and the permeability, μ_0, of space, the product of which is $1/c^2$. The following consideration requires pure electric forces to be directly proportional to c, as do purely magnetic forces. Two electrically charged particles held motionless in their rest system by an equal and opposite force due to one of the other three forces must not move together or apart when we transform to another, moving, coordinate system, in which the magnetic force comes into play. Since relativity applies to the electromagnetic force, it must also apply in the same way to the other three forces. Because relativity, which very much depends on c, thus applies to all the forces, then they all must depend on c the same way as the electromagnetic force does. So all process rates are directly proportional to c.
50. As in eq. (4) with $2d = \lambda$.
51. The window is moving out from us at the speed of light, so that in 100 years it will be 6,100 light-years away.
52. The energy of a photon is $E = h f$, where f is the frequency and h is Planck's constant. The simplest way I can imagine to have consistency between the laws of physics in the two regions is to have the energy, E, stay constant as the photon passes through the slowdown interface. That would require h in deep space to be much lower than normal as measured by earth clocks. A reviewer points out a reference which relates c and h: Backerra, A.C.M., Relation between Planck's constant and speed of light, predicting proton radius more accurately, *Applied Physics Research* **11**(5):1–9, 2019 | doi.org/10.5539/apr.v11n5p1. I do not vouch for the reliability of this article, but it may at least be right on h and c.
53. For one who shares my rather idiosyncratic views on space and relativity, the rotation is with respect to the space in Earth's locality. A more conventional reader could consider the rotation as relative to the Spirit of God in Genesis 1:2.
54. The angular momentum of a massive rotating body like the deep would be very large. A reviewer asks how that would be transferred to various celestrial bodies, like galaxies. I don't know in detail, but I imagine that each watery ball left behind by the expansion of the waters above would be spinning. The spin axes would be tilted and precessed by various forces in the locality. Not only that, but there would be a very slow general rotation of the cosmos as a whole with respect to the fabric of space. The total angular momentum would be conserved (the same as the initial deep had), and it would have a spin axis in a particular direction. Various observers have found some evidence for such an axis, and also a preferred average direction of the galaxies' rotations. There is plenty of room for some creationist theorist to work out the details and make some quantitative predictions.
55. For a computer simulation video of the Antennae Galaxies collision see youtube.com/watch?v=QcDtJ_-jdMw.
56. Genesis 1:5, 14.

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John Nelson Darby, the Scofield Reference Bible, and the rise of old-earth creationism

Andrew Sibley

The gap theory, which postulates a gap of unknown length between the first two verses of Genesis, was popularized in evangelical circles in the 19th century through John Nelson Darby's teaching and writing, and in the writing of George Hawkins Pember (1876), and then in the text-notes of Cyrus Ingerson Scofield's Reference Bible (1909 and 1917). The gap theory had been developed initially by Thomas Chalmers (1804 and 1814) in response to a growing belief in an old Earth, for example in James Hutton's writing in the late 18th century. It was supported by Charles Goodwin's contribution to the liberal and critical anthology *Essays and Reviews* (1860). This accommodation to secular geology spread through many conservative evangelical congregations, although Darby and Scofield strongly resisted belief in evolution, especially of man.

The influence of John Nelson Darby (1800–1882), and the Scofield Reference Bible (1909, 1917), led many members of the Plymouth Brethren movement to adopt belief in old-earth creation, as opposed to young-earth creation, or theistic evolution. The preferred old-earth view was the gap theory, with less willingness to accept belief in pre-Adamic races, or the day-age position. The gap theory (sometimes referred to as the ruin/reconstruction theory) had been expounded by Thomas Chalmers as early as 1804 (at the age of 24) and published in 1814.[1] Chalmers' claims followed James Hutton's promotion of an old Earth in the late 18th century, and attempts to trace Chalmers' belief to earlier times are not strongly supported.[2] Chalmers wrote as follows:

> "The beginning spoken of here has been variously estimated. My own opinion, as published in 1814, is that it forms no part of the first day but refers to a period of indefinite antiquity when God created the worlds out of nothing. The commencement of the first day's work I hold to be the moving of God's Spirit upon the face of the waters. We can allow geology the amplest time for its various revolutions without infringing even on the literalities of the Mosaic record—while Nature herself bears witness to the need of a creative interposition ... ."[3]

The Plymouth Brethren movement began in the early 19th century at a time when British geologists had moved to accept belief in deep time. Leaders of the Brethren movement included the Church of Ireland minister John Nelson Darby (figure 1), as well as other Anglican and Catholic clerics from Britain and Ireland, and the Lutheran minister George Müller from Germany. These were men who had a desire to pursue Christian faith without the formality of traditional religion. There was also a strong interest in end-time prophecy within the movement, and a particular dispensationalist approach to the reading of Scripture among many members.[4] A dispensation of grace can be thought of as "a period of time during which man is tested in respect of obedience to some specific revelation of the will of God."[5]

John Nelson Darby was very industrious in his writing, and his influence was (and is) huge in terms of dispensationalism, although not always recognized.[6] However, despite affinity for the gap theory, within the movement there were still some notable characters who were committed to a young Earth, such as Philip Henry Gosse in his work *Omphalos* (1857). Gosse argued that miracles may lead to an apparent age, such as when Jesus turned water into wine. Unfortunately, he over-extended the argument to suggest that Adam must have had a naval, and that fossils may have been deliberately planted in the ground to give a history that never existed in reality.

The Brethren movement grew enthusiastically, but later divided into the Open Brethren and Exclusive Brethren. The movement has produced a disproportionate number of academics over the years in relation to their numbers, perhaps because of connections in Victorian society, and a commitment to studying the biblical text as well as the natural world. It may be noted that modern proponents of old-earth creation in the UK, with links to the Plymouth Brethren movement, include well-regarded Christian leaders, such as John Lennox,[7] Alister Noble,[8] and Roger Forster.[9] These leaders are sympathetic to Intelligent Design, but have at times been critical of the young-earth position, partly for its alleged novelty (erroneously claimed) within Christian tradition.[10]

Darby's position with regards to the creation account was popularized through the text notes of the Scofield Reference Bible, first published in 1909 by Cyrus Ingerson Scofield (figure 2), which advocated for an old Earth. The second, more influential and widely available, 'new and improved' edition, which is discussed here, was first published in 1917. He advanced the gap theory in the marginal note of Genesis 1:2 (discussed below) (figure 3).

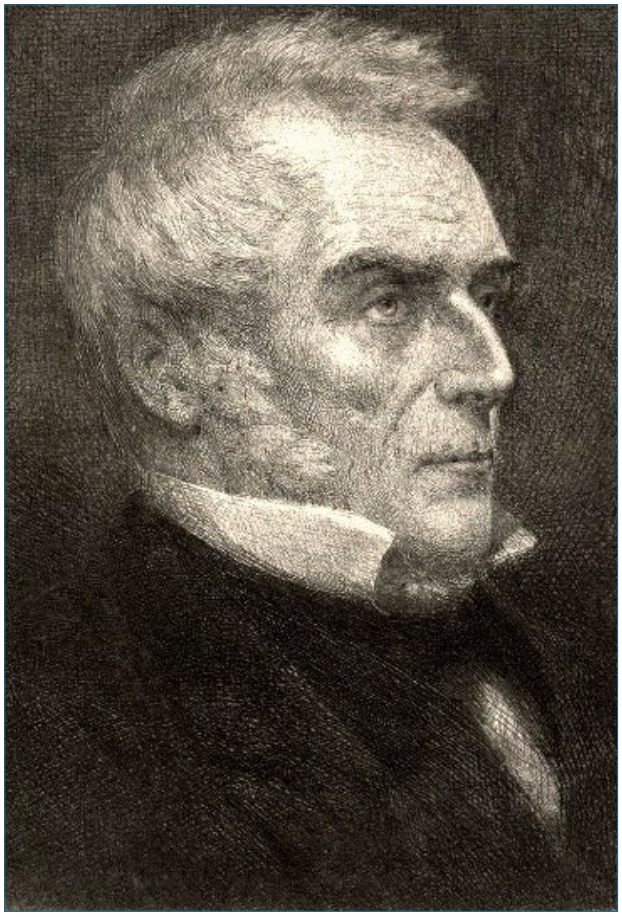


Figure 1. John Nelson Darby (1800–1882)

John Nelson Darby (1800–1882)

John Nelson Darby was a prolific writer and influential Christian leader, but argued for the gap theory in a number of works. Through a dialogue on apologetics, entitled "What has the Bible Taught? And what has Geology Proved?" (1862), Darby expressed scepticism of the claims of the 19th-century geologists, considering that they rested on "very doubtful evidence".[11] His *Dialogues* were written in response to the influential anthology *Essays and Reviews* (1860), edited by John Parker.[12] Although six of the seven authors of *Essays and Reviews* were Anglican clerics, their writing supported biblical criticism, rejected miracles and the veracity of biblical prophecy. Darby was very respectful to a literal reading of Scripture after the first two verses, but in some ways was unduly influenced by *Essays and Reviews*.

In terms of geology and the gap theory, Darby suggested the possibility that not all fossil-bearing strata were laid down by the biblical Flood, so he was willing to entertain a gap of indeterminate length between Genesis 1:1 and 1:2. In the context of a theory of mountain upheaval, he was willing to consider that some strata already contained fossils when the Deluge occurred, and so not all geological remains were cause by the Flood:

> "... nor can I see that the Deluge accounts for all [geological remains], because if ... the upheaval theory be correct ... then the mountains which existed at the time of the Deluge have broken up strata which had various fossils already buried in them; that is, the Flood does not appear to have brought them, while unconformable strata prove deposits after the upheaval. Thus there is a proof of strata of different ages. But I am not satisfied entirely as to all the data."[13]

However, despite this assertion, one of the main lines of evidence that led Darby towards some scepticism about gradual deposition in geology was the presence of polystrate vegetation, such as trees, that extended many metres through the strata. An example was a tree of 20 m (60 ft) length at Craigleith quarry, near Edinburgh, that lay at an angle of 40° through the horizontal strata (Lower Carboniferous, said to be 330 Ma).[14] The belief that such a tree trunk could remain over a period 20,000 years without decomposing Darby considered untenable.[15] Darby further quoted Professor John Phillips' *Manual of Geology* (1855) in relation to fossil vegetation and strata at High Whitby and Yorkshire.[16] From this Darby wrote that "Such facts as these subvert, as far as I can judge, the whole system of geologists as to deposits."[16] He commented that "We must distinguish between the facts of geology and the conclusions of geologists. I admit the former; the latter are extremely uncertain, in some respects impossible to be true."[17]

Despite healthy scepticism towards some of the untenable claims of 19thcentury geologists, Darby was willing to read into the Genesis creation narrative a gap between verses 1 and 2 that could be filled with millions of years, but unknown in detail—divine revelation was silent on the matter: "What came between the first verse and the second, does not enter into the object of the revelation. Creation, and the forming of the present earth did."[18]; and "Scripture, which does not reveal scientific facts, is totally silent on them, but leaves a gap which may have been filled by millions of years."[17] Similar comments appear in *Hints on the Book of Genesis* (1873), suggesting that Scripture is silent on the age of the earth, but not really believing stated ages longer than thousands of years.[19] Darby also commented on such a gap in a Synopsis of the Old Testament (1857–1862), writing that "What may have taken place between that time and the moment when the earth (for it only is then spoken of) was without form and void, is left in entire obscurity."[20]

He was less impressed by the day-age theory. The belief that the six days of creation were extended periods of time he considered to be "somewhat forced".[21] The structure and coherence of the Genesis 1 account (after verse 1) led to the view that it was "as a statement of the formation of our present world". Although he qualified this by commenting that he had no "a priori opinion or moral objection to the system of the days being lengthened periods".[17]

He was unequivocal when it came to understanding the more recent creation of Adam and Eve, considering their creation to be necessarily historical—Adam was specially created as Genesis states, so belief in pre-Adamic races was untenable. In terms of geological evidence, he was sceptical of reports of extinct mammal bones being found with human artefacts in Europe, such as stone tools.[22] He was also adamant that Scripture simply does not allow pre-Adamic races, commenting: "As regards the single pair, Christ and his apostles, particularly Paul, speak of the first man and woman as alone; and all Paul's doctrine is based on it." and "the whole account in both chapters speak, as the Lord says, of one man and one woman."[23] The text, he comments, reveals "an innocent man fallen and driven out, as the head of a race, from God."[23] This is because the Hebrew text speaks of man in the singular in the first chapter of Genesis, and then in the plural after the formation of Eve, and so all of humanity is "derived from one stock."[23] Attempts by academics in America to counter this he thought were "excessively poor" and that Livingstone's (1813–1873) observations were more accurate relating to the unity of mankind.[24] Livingstone had travelled throughout Africa in the 19th century and opened the continent to British missionaries.

The position of Darby on these matters was later relayed more widely in the Scofield Reference Bible (as discussed below), and subsequently informed the thinking of many Christians beyond the confines of the Plymouth Brethren.

George Hawkins Pember (1837–1910)

Another leading Brethren proponent of the gap theory was George Pember, who saw that it might offer a way of harmonizing the Bible with the science of geology. His most notable work along these lines was *Earth's Earliest Ages* (first published in 1876), which went through several editions. He was also interested in end-time prophecy and in animal welfare. Commenting upon the ruin of a former world, he wrote:

> "It is thus clear that the second verse of Genesis describes the earth as a ruin; but there is no hint of the time which elapsed between creation and this ruin. Age after age may have rolled away, and it was probably during their course that the strata of the earth's crust were gradually developed."[25]

Whereas Darby had recognized the possibility that the Flood may have caused some of the strata (as noted above, specifically the Carboniferous), Pember had a different view. He saw in the gap the fall of Satan, along with the demise of the dinosaurs prior to Adam, and saw faint glimmers of this from the Scriptures.

> "Since, then, the fossil remains are those of creatures anterior to Adam, and yet show evident tokens of disease, death, and mutual destruction, they must have belonged to another world, and have a sin-stained history of their own, a history which ended in the ruin of themselves and their habitation."[26]
>
> "Yet, as we peer hopelessly into the night, a faint and unsteady gleam seems to emanate from the Scriptures in our hands, a very different light from which they pour upon other subjects, scarcely more than sufficient to make darkness visible, but enough to reveal the outline of a shadowy form seated on high above the desolation, and looking sullenly down upon his ruined realm. It is our own great enemy, the Prince of this World, and of the Power of the Air."[27]

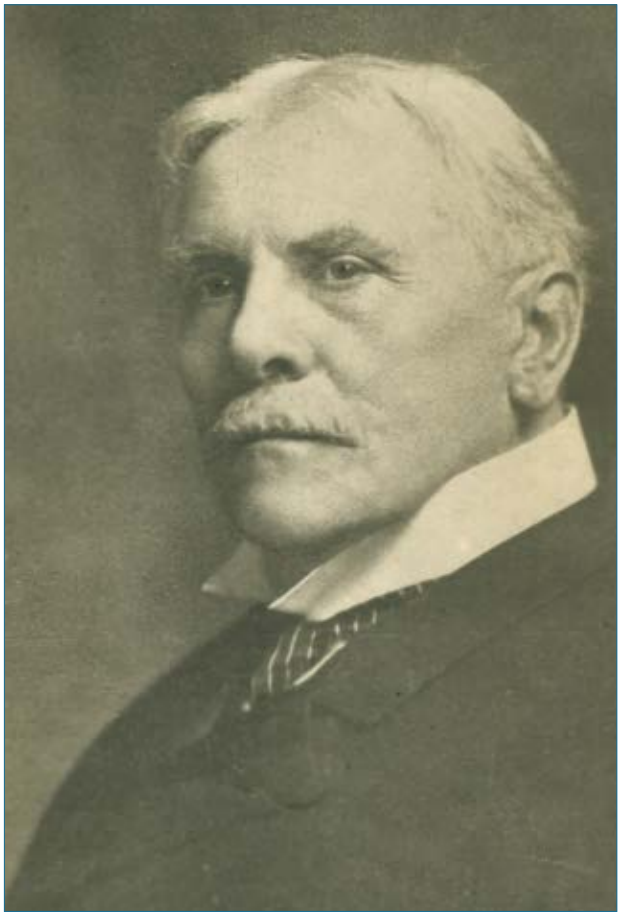


Image: Wikimedia / Public Domain

Figure 2. Cyrus Ingerson Scofield (1843–1921); photo from about 1920.

While in the text Pember infers that Satan was the cause of the rebellion, in the subheading to the section he writes of the "Probable existence of man in preadamite times".[21] Pember's allusion to belief in pre-Adamic man appears several years after Lyell and Darwin had argued that mankind lived long before the biblical accounts allowed.[28] This view had been advocated by the Huguenot Isaac La Peyrère (1596–1676) in his work *Prae-Adamitae*, published in Latin in 1655 (and in English in 1656). However, the Brethren saw the theological difficulties in this opinion (discussed further below), and Darby's view was preferred. It would seem, however, that the gap theory allowed a great deal of speculation for Bible students and

scholars to fill in. Trying to accommodate Scripture to the latest science risks undermining core Christian doctrines.

Cyrus Ingerson Scofield and the Scofield Reference Bible

Cyrus Ingerson Scofield (1843–1921) trained as a lawyer and rose to the position of District Attorney for Kansas, before being forced to resign due to financial scandals; that, and heavy drinking, also led to divorce. Following religious conversion, he was ordained as a Congregational minister in 1883 and became a well-known author, most notably through the production of the Scofield Reference Bible (1909, revised 1917).[29] He was mentored by James H. Brookes, who had close links with Darby. Through such connections Darby's theology was popularized in the reference Bible, gaining widespread appeal among the wider evangelical community. Scofield's Bible contained section headings and text notes that directed the reader towards a dispensationalist interpretation, and towards belief in old-earth creation. However, the direct influence of Darby's Exclusive Brethren became increasingly marginalized in Britain (though it remained influential in the Chinese House Church movement through Watchman Nee and Witness Lee).

The main differences between the 1909 edition and that of 1917 are the addition of a preface and Panoramic View of the Bible, the inclusion of dates at the head of the central column of each page, and the change of Roman numerals to Arabic ones for verse references. The 1917 edition continued to be published until 1967 and was hugely popular, with only very minor changes thereafter. Showing superficial adherence to Ussher's chronology, the introductory comments of the 1917 edition (figure 3) state that Genesis covers a period of 2,315 years, with creation dated to 4004 BC. And yet before each of the first three verses of Genesis 1, there are inserted subheadings as follows: (verse 1) *The Original Creation*, (verse 2) *Earth made waste and empty by judgement,* (with a reference to Jeremiah 4:23–26), and (verse 3) *The new beginning—the first day: light diffused.*

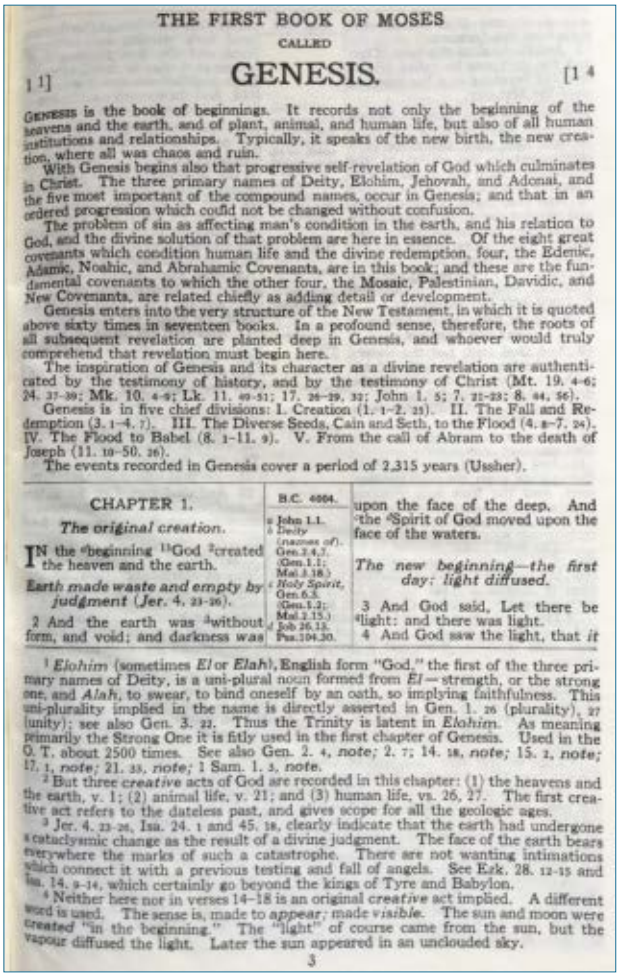
With regard to verse 2, the words 'waste and empty', and a reference to the same verse in Jeremiah (4:23), appeared in Goodwin's contribution to *Essays and Reviews* (although in reverse order). Goodwin wrote: "perhaps the words 'empty and waste' would convey to us at present something more nearly approaching the meaning of *tohu va-bohu* than those which the translators have used."[30] The words also appear in Darby's Old Testament translation of 1890: "And the earth was waste and empty". Although this was published after Darby's death (his supporters used material from his German and French Bibles), it seems to have reflected Darby's view: the German *Darby Unrevidierte Elderfelder* version (1871) has "wüst und leer", the Pau-Vevey French translation (1885) has "désolation et vide". The word 'waste' also appears in Darby's *Dialogue on Essays and Reviews*, that "Earth now comes out of the waste to be fruit-bearing."[31]

In Scofield's text notes relating to Genesis 1, it is asserted that three creative acts were recorded in the text: "(1) the heavens and the earth, v. 1; (2) animal life, v. 21; (3) and human life, vv. 26, 27. The first creative act refers to the dateless past, and gives scope for all the geologic ages."[32] As noted, justification is given in terms of the text of Jeremiah 4:23–26 (and also Isaiah 24:1 and 45:18), which he thought clearly indicated that the earth had been subject to "a cataclysmic change as the result of divine judgment." Marks of such a catastrophe were said to be observable widely across the earth, effectively ascribing the evidence of the actual biblical cataclysm (Noah's Flood) to another watery event that was before Adam. He writes that with the "restoration of dry land", the seeds of plants would have survived the catastrophe and germinated once more. Instead, it was "*animal* life which perished, the traces of which remain as fossils [emphasis in original]."[32] The stated purpose of ascribing the fauna found in the fossil record to the 'primitive creation', is so that no conflict need arise between science and the Genesis creation account. The judgment of the primitive catastrophe he also considered to be connected to the fall of Satan and the fallen Angels, with reference to Ezekiel 28:12–15 and Isaiah 14:9–14. The inference is that these passages go beyond the immediate reference to the rulers of Tyre and Babylon.[32]

Furthermore, in context, Jeremiah 4:23–26 is a prophecy against Israel; Jeremiah is seeing the future state of the land and writing in the present tense, comparing the destruction of Israel to the condition that existed in Genesis 1:2—that is 'formless and empty'. It doesn't mean that we should read into the first two verses the destruction, or *waste*, of a former world as suggested in Goodwin's contribution to the critical *Essays and Review*.[30] The same applies for Isaiah 24, which should not be thrown into the past, but read in its own context as a prophecy against Israel.

With the primitive creation of the heavens and the earth ascribed to before the gap, Scofield (and Darby) had to deal with the formation of light, and the planets and stars that were placed within the text of the six-days of creation. Scofield suggested that the stated creation of light (in verse 3) should not be read as an 'original *creative* act' because "A different word is used." The heavenly bodies merely appeared and became visible, and the sun shone its light as the clouds dissipated.[33]

Scofield was more sympathetic than Darby to the view that the days of creation need not be 24 hours long, but could be "a period of time, long or short, during which certain revealed purposes of God are to be accomplished". Even though the text specifies 'evening' and 'morning', which may restrict the interpretation to a solar day, he suggested that "the frequent parabolic use of natural phenomena" may justify a different conclusion. Each day may then be seen as "a period of time marked off by a beginning and ending."[34]



THE FIRST BOOK OF MOSES
CALLED
GENESIS.

GENESIS is the book of beginnings. It records not only the beginning of the heavens and the earth, and of plant, animal, and human life, but also of all human institutions and relationships. Typically, it speaks of the new birth, the new creation, where all was chaos and ruin.

With Genesis begins also that progressive self-revelation of God which culminates in Christ. The three primary names of Deity, Elohim, Jehovah, and Adonai, and the five most important of the compound names, occur in Genesis; and that in an ordered progression which could not be changed without confusion.

The problem of sin as affecting man's condition in the earth, and his relation to God, and the divine solution of that problem are here in essence. Of the eight great covenants which condition human life and the divine redemption, four, the Edenic, Adamic, Noahic, and Abrahamic Covenants, are in this book; and these are the fundamental covenants to which the other four, the Mosaic, Palestinian, Davidic, and New Covenants, are related chiefly as adding detail or development.

Genesis enters into the very structure of the New Testament, in which it is quoted above sixty times in seventeen books. In a profound sense, therefore, the roots of all subsequent revelation are planted deep in Genesis, and whoever would truly comprehend that revelation must begin here.

The inspiration of Genesis and its character as a divine revelation are authenticated by the testimony of history, and by the testimony of Christ (Mt. 19. 4-6; 24. 37-39; Mk. 10. 4-9; Lk. 11. 49-51; 17. 26-29, 32; John 1. 5; 7. 21-23; 8. 44, 56).

Genesis is in five chief divisions: I. Creation (1. 1–2. 25). II. The Fall and Redemption (3. 1–4. 7). III. The Diverse Seeds, Cain and Seth, to the Flood (4. 8–7. 24). IV. The Flood to Babel (8. 1–11. 9). V. From the call of Abram to the death of Joseph (11. 10–50. 26).

The events recorded in Genesis cover a period of 2,315 years (Ussher).

CHAPTER 1.

B.C. 4004.

The original creation.

IN the beginning [1]God [2]created the heaven and the earth.

Earth made waste and empty by judgment (Jer. 4. 23-26).

2 And the earth was [3]without form, and void; and darkness was upon the face of the deep. And [4]the Spirit of God moved upon the face of the waters.

The new beginning—the first day: light diffused.

3 And God said, Let there be [5]light: and there was light.

4 And God saw the light, that *it*

[1] *Elohim* (sometimes *El* or *Elah*), English form "God," the first of the three primary names of Deity, is a uni-plural noun formed from *El*—strength, or the strong one, and *Alah*, to swear, to bind oneself by an oath, so implying faithfulness. This uni-plurality implied in the name is directly asserted in Gen. 1. 26 (plurality), 27 (unity); see also Gen. 3. 22. Thus the Trinity is latent in *Elohim*. As meaning primarily the Strong One it is fitly used in the first chapter of Genesis. Used in the O. T. about 2500 times. See also Gen. 2. 4, *note*; 2. 7; 14. 18, *note*; 15. 2, *note*; 17. 1, *note*; 21. 33, *note*; 1 Sam. 1. 3, *note*.

[2] But three *creative* acts of God are recorded in this chapter: (1) the heavens and the earth, v. 1; (2) animal life, v. 21; and (3) human life, vs. 26, 27. The first creative act refers to the dateless past, and gives scope for all the geologic ages.

[3] Jer. 4. 23-26, Isa. 24. 1 and 45. 18, clearly indicate that the earth had undergone a cataclysmic change as the result of a divine judgment. The face of the earth bears everywhere the marks of such a catastrophe. There are not wanting intimations which connect it with a previous testing and fall of angels. See Ezk. 28. 12-15 and Isa. 14. 9-14, which certainly go beyond the kings of Tyre and Babylon.

[4] Neither here nor in verses 14–18 is an original *creative* act implied. A different word is used. The sense is, made to *appear*; made *visible*. The sun and moon were created "in the beginning." The "light" of course came from the sun, but the vapour diffused the light. Later the sun appeared in an unclouded sky.

3

Figure 3. Scofield Reference Bible (1917 version) showing the first page of Genesis

Despite the move to imagine a primitive creation and former divine judgment that left the fossil evidence, Scofield, like Darby, was committed to rejecting the evolution of mankind. The revealed facts he considered are that "(1) Man was *created* not *evolved* [emphasis in original]", a position which he said was supported by the teachings of Christ: "This is … expressly declared, and the declaration is confirmed by Christ", referencing (Matthew 19:14 and Mark 10:6).[35] He noted a huge gulf between humanity and the animals, the highest of which exhibit no evidence of 'God-consciousness', which is akin to 'the religious nature'—nothing in science has bridged this distinction.[35]

It may be noted that a gap between Genesis 1:1 and 1:2 fitted within Darby's wider dispensationalist theology, and this theology was supported by Scofield. As noted, dispensationalism divides Judeo-Christian history into distinct periods of grace for mankind, the first beginning with Adam, and there are also theological gaps relating to eschatology.[36] But while the gap theory fitted with the division of Scripture along dispensationalist lines, I don't think it was the main driver for acceptance: respectability in scientific society was probably a stronger reason. Indeed, the gap between the first two verses was specifically excluded from Scofield's seven dispensations, which related only to mankind.

However, Scofield argued that it was right to divide Scripture. In a pamphlet entitled *Rightly Dividing the Word of Truth*[37] Scofield appealed to 2 Timothy 2:15 in support of his position, which reads in the KJV:

> "Study to show thyself approved unto God, a workman that needeth not to be ashamed, rightly dividing [Gk: ὀρθοτομοῦντα, *orthotomounta*] the word of truth" (2 Timothy 2:15).

He wrote that "The Word of truth, then, has right divisions, and … any study of that Word which ignores those divisions must be in large measure profitless and confusing." The phrase "rightly dividing the word of truth" provided justification for this hermeneutic. And yet the KJV translation, on which this interpretation rests, is rather poor. A more accurate rendition was given in Darby's more literal translation from 1890, which reads "cutting in a straight line the word of truth." Darby had a much greater ability in Greek and did not seem to use this verse to justify his gap theory or his wider dispensationalist theology.[38] Rather surprisingly, Scofield adds no text note to 2 Timothy 2:15 in his reference Bible relating to division, perhaps suggesting he may have recognized his earlier pamphlet was in error.[39]

Conclusion

The position of Darby, Pember, and Scofield has been outlined. The gap theory allowed these theologians to imaginatively fill in a story between Genesis 1:1 and 1:2, in order to harmonize the latest geological claims relating to deep time with the biblical account. Thus, the gap theory was developed in the 19th century in response to the claims of secular geology. The theological justification for the gap theory appears to have arisen from Thomas Chalmers, and Parker's *Essays and Review*. This later work was written by liberal Christians who were engaged in biblical criticism, and in many ways opposed to belief in miracles and a literal reading of the text. Despite the accommodation of the biblical text by Darby and Scofield towards acceptance of an old Earth, their opposition to the evolution of mankind led many Brethren and other evangelicals to resist acceptance of evolution over subsequent decades. It is notable that a number of contemporary adherents to Intelligent Design and old-earth creation from the British Isles have some connection to the Brethren movement.

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3. Chalmers, T., *Posthumous works of the Rev. Thomas Chalmers*, Rev. Hanna, W. (Ed.), vol. 1, Thomas Constable & Co., Edinburgh, p. 1, 1852.
4. Darby's dispensationalism divided Scripture into periods of grace, and more so than those taught by Reformed Calvinists. It should be noted that CMI doesn't take an official position on eschatology.
5. This is from Scofield, C.I., *Scofield Reference Bible* (KJV), Oxford University Press, Oxford, p. 5, 1917. Footnote to Genesis 1:27.
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10. See, for example, Mortenson, T., *The Great Turning Point*, Master Books, Green Forest AR, 2004.
11. Darby, J.N., *Dialogues on the Essays and Reviews*, *What has the Bible Taught? And what has Geology Proved?* W.H. Broom, London, p. 131, 1862. "*H.* To tell you the honest truth, I think the Mosaic account of the creation much more certain than any geological system. First, the direct proofs of Scripture are, to me, infinitely more solid and sure than any geological conclusions; and the geological conclusions I have seen arrived at, seem to me to rest *in fact* on very doubtful evidence." Darby's *Dialogues* was written in response to the influential anthology: Parker, J.W. (Ed.), *Essays and Reviews*, Parker and Sons, London, 1860. Although six of the seven writers were Anglican clerics, their writing supported biblical criticism, rejected miracles, and the veracity of biblical prophecy.
12. Parker, ref. 11.
13. Darby, ref. 11, pp. 132–133.
14. For more information, see: Lyon, G., Discovery of a new fossil tree in Craigleith Quarry, Edinburgh, *Trans. of the Edinburgh Geological Society* **2**(2):219–220, 1873 | doi.org/10.1144/transed.2.2.219. This suggests that Darby was slightly in error over the length of the finds.
15. Darby, ref. 11, pp. 133–134: "at Craigleith, near Edinburgh, a tree some sixty feet long, lies slanting at an angle of 40° across the strata in its whole length. Now that a tree remained 20,000 years slanting thus, while the sea deposited this strata, is not to be believed."
16. Darby, ref. 11, p. 134. Darby's quotation of John Phillips: "the nearly vertical position of certain fossil plants, a phenomenon by no means rare amongst sandstone rocks, affords good grounds for caution in assigning very great extensions of years to geological periods … the accumulation of transported sediment must have been so rapid as to prevent the decomposition of the vertical [Phillips: cortical] portions of the plants. … No one doubts that the bed of stone three feet thick which encloses equisetum columnare at High Whitby, was laid by a single inundation …; and again [Phillips: About the same] the sigillaria in the coal sandstones of Yorkshire … pass through more than one, sometimes four or five beds of stone." This is from Phillips, J., *Manual of Geology, Practical and theoretical*, Richard Griffin and Co., London and Glasgow, pp. 621–622, 1855. Darby's quotation is not clearly referenced, and rather careless (differences with the original are in square brackets above).
17. Darby, ref. 11, p. 146. Darby further defended the Deluge in 1863 against Bishop Colenso, although he saw it more in supernatural terms; see: Darby, J.N., *Dr Colenso and the Pentateuch*, G. Morrish, London, pp. 8–9, 1863.
18. Darby, ref. 11, p. 138.
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20. Darby, J.N., Synopsis of the Books of the Bible, vol. 1; in: *Genesis to II Chronicles*, 3rd revised edn, G. Morrish, London, p. 10, 1857–1862. "Thus also, as regards this earth, except the fact of its creation, nothing is said of it beyond what relates to the present form of it. The fact is stated that God created all things, all man sees, all the material universe. 'In the beginning God created the heavens and the earth.' What may have taken place between that time and the moment when the earth (for it only is then spoken of) was without form and void, is left in entire obscurity. Darkness was then upon the face of the deep, but the darkness is only spoken of as resting on the face of the deep."
21. Darby, ref. 11, pp. 136–137. "I have no kind of opinion or moral objection to the system of the days being lengthened periods, but it seems to me somewhat forced."
22. Darby, ref. 11, pp. 131–152, more specifically, p. 135. This was also the view of Philips in his *Manual of Geology*, pp. 435–438. See also: Sibley, A., William Pengelly's Brixham cave excavations, and belief in the antiquity of man, creation.com/pengelly-cave-excavations, 2022.
23. Darby, ref. 11, p. 148–149.
24. Darby, ref. 11, p. 149–150. And see: Livingstone, D., *Missionary Travels and Researches in South Africa*, John Murray, London, 1857.
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30. Goodwin, C.W., On the Mosaic cosmogony; in: Parker, J.W. (Ed.), *Essays and Reviews*, Parker and Sons, London, pp. 218–219, 1860. The reference is given to Jeremiah 'chap. iv:33', but it is v. 23 in the KJV.
31. Darby, ref. 11, p. 140.
32. Scofield, ref. 29, text notes on vv. 1, 2, and 11.
33. Scofield, ref. 29, text notes on vv. 3, 14–18, and Darby, ref 19. Darby did not consider the large eyes of the ichthyosauri living in the darkness of the deep (Genesis 1:2) to be a problem. He states: "I have no difficulty about the light. …it is not the object of scripture to teach it."
34. Scofield, ref. 29, text notes on verse 5.
35. Scofield, ref. 29, text notes on verse 26.
36. Huebner, R.A., John Nelson Darby: Precious truths revived and defended, vol. 1; in: *Revival of Truth 1826–1845*, 2nd edn, Present Truth Publishers, Jackson, NJ, pp. 7–18, 2004. For example, that the church is a parenthesis in the narrative of Israel, that a gap exists somewhere between Daniel's 69th week and the 70th, and also between a secret rapture and the second coming of Christ.
37. Scofield, C.I., *Rightly Dividing the Word of Truth*, Loizeaux Bros., Bible Truth Depot, New York, 1896.
38. The normal usage of the verb (ὀρθοτομέω orthotomeó) is to cut straight in terms of a road or path between two places, or to plough a straight furrow. It implies, then, that we are to handle and use the Word of God in a right manner and not to divide it up. Darby evidently had other influences that led him to accept the gap theory.
39. Scofield, ref. 29, opening comments in *A Panoramic View of the Bible*, Scofield also seems to have softened his view regarding divisions in the Bible, although still retaining a gap between the first two verses.

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